INTERMEDIATE AND GRAMMAR METHODS

A SERIES OF

PRACTICAL HOME STUDIES IN PEDAGOGY

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VOLUME TWO

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LESSON TWELVE

ELEMENTARY SCIENCE

INTRODUCTION

1. Scope of the Work. Elementary science in the grades above the primary should include the study of those problems of life which for their solution depend upon a knowledge of the leading facts of the various branches of physical science. It is within the province of the elementary school to acquaint the pupils with the facts of these various branches of science which pertain directly to their welfare and happiness, also to give them some idea of the principles upon which classification depends and to lead them to recognize the most prominent groups in the vegetable and animal kingdoms. Minute classification should not be attempted, neither should the study of those phenomena whose principles and laws are difficult to discover be introduced.

2. Importance. The applications of science to life in the last half-century have changed our surroundings to such an extent that we practically live in a new world, and to live most advantageously in the present day one must understand these conditions.

The truths of science are universal. The problems that arise in science are the same in kind as those that arise in life. An understanding of the laws of nature and obedience to them are essential to health and happiness; the economic benefits to the country that might be derived from a knowledge of certain facts learned through the study of science would amount to hundreds of millions of dollars annually. From all points of view no more useful or practical subject can be taken up in the elementary schools than the study of the elements of the various branches of natural science, and this study should receive much more attention than is generally given it.

3. Relation to Other Branches. As science touches all phases of life, so the lessons in elementary science are more or less closely related to all other branches in the course of study. Many allusions in the reading lesson are explainable only by an understanding of the elementary principles of some branch of science. The science lessons also furnish excellent topics for oral and written descriptions, and they constitute the foundation of elementary geography.

The relation of science to literature constitutes one of the most fascinating features of the work. Since we cannot read Longfellow, Bryant, Whittier, Holmes and Lowell, among our own poets, or Tennyson, Wordsworth or others, among the English poets, without having our thoughts constantly attracted to the beauties and wonders of nature, we ought not, in the study of natural objects, to omit references to the beautiful descriptions found in the works of our great writers or in the works of those of less importance. This correlation can be easily arranged by having a group of pupils in the literature class study some selection which bears directly upon the topic in science that is under discussion. If you are studying clouds, have the literature class study Shelley's poem, *The Cloud*; if you are studying about frost, use the picture of the frozen brook in Lowell's *Vision of Sir Launfal*, in the same way. Many similar illustrations will occur to you. Some series of readers relate these lines of work very successfully, but the most comprehensive and useful of all books upon this feature of science work is Miss McGovern's,[1] which was compiled especially for this purpose.

4. Purposes. The chief purposes of the study of elementary science may be stated as follows:

(1) To make the child acquainted with his surroundings. By this we mean all those natural conditions—plants, animals, soil, climate and scenery—which combine to form environment.

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[1] Anna E. McGovern: *Nature Study and Literature.* 372 pages. Republican Printing Company, Cedar Rapids, Iowa. $1.25.

(2) To lead the pupils to see beauty in the objects of nature. Many people, even in the country, are blind to the beauty of the wild flowers, the songs of the birds, the ever-varying tints of the sky by day and the glory of the heavens by night. Children should be led to discover the beauty which is in the most common things, such as the plants and insects which they often crush under their feet; in finding this beauty they will also learn something of the harmony that exists in nature.

(3) "To prepare children for real life by enabling them to gain an understanding and mastery of the physical conditions of life and the many varied utilities of nature." This purpose is usually considered to be the practical or economic feature of elementary science, and it is a feature through which lessons on this subject win approval with a large majority of the patrons of the school. Such lessons lead the pupils to distinguish between the useful and the harmful in their surroundings. Some species of insects destroy crops and cause great damage. Certain weeds are harmful, because they spread so rapidly, and occasionally plants and animals are met that are harmful to man. Children should learn to distinguish between these classes of objects, how to propagate those that are useful and how to destroy those that are harmful.

(4) To remove fear and prejudice founded upon false ideas which, because of superstition, have been handed down from one generation to another. The majority of people hold foolish notions about many members of the animal kingdom. One is afraid of mice, and another, of bees. Nearly all persons are terrified at the sight of a snake, and much of the wanton destruction of life is due to this fear and prejudice.

Many people hold equally ridiculous superstitions concerning the moon, the weather, the number thirteen, thunder and lightning, and various other phenomena. If children obtain an understanding of the laws and phenomena of climate, and especially of storms, they seldom entertain such ideas, the possession of which is accompanied with more or less dread and worry.

(5) To lead the pupils to become self-reliant. In no subject can the pupil be thrown more completely upon his own resources than in elementary science. Here he must discover things for himself, test his own knowledge and prove his conclusions. Through this method of study he learns to trust his powers, and he acquires a feeling of certainty which gives him a degree of independence and self-confidence.

(6) To teach pupils respect for labor. This applies particularly to the seventh and eighth grades. A study of natural forces and laws and their products reveals to the child the universal law that only by its own activity can a living thing survive. Every living thing, from the lowest plant or animal to man, works, and it is only by its work that it can exist, grow and fill its place in the world. When this truth is impressed upon the mind it lends a dignity to labor which many young people never before realized.

(7) To develop character. This is the crowning purpose of all studies, and the one in elementary science towards which all the other purposes point. In the study of science the child is searching for truth; in the study of natural phenomena he acquires the habit of careful observation, and also the habit of making accurate statements concerning small things, both of which are important steps in leading him to a love for truth. As he discovers the usefulness of plants and animals, a spirit of kindness is developed which leads him to treat kindly and to care for those creatures that are more or less dependent upon him; naturally, as he comprehends the harmony running through nature and the majesty of natural law, he acquires a reverence for the Creator of all things.

5. General Directions. While it is not probable that all of the following directions will apply to each lesson, some of them will apply to all lessons:

(1) Every lesson contains a central thought, around which all others should be grouped. Find this thought in planning for the lesson, and so present the subject as to lead

the pupils to search for it until they succeed in finding it. The fact and truth thus discovered will give rise to one or more problems, the solution of which will tax the reasoning power of the pupils and also hold their interest upon the work. These problems can be brought to the attention of the pupils by directing their observation and then questioning them. Ask the children to watch a squirrel climbing a tree, then tell how it does it. How does the squirrel crack a nut? Did you ever find a squirrel's nest? Where was it? Of what was it made? A similar plan can be pursued with many natural objects.

(2) The central truth of the lesson usually has numerous applications. Either by questions or direction the pupil should be led to find them.

(3) In the study of a unit, first direct the efforts of the pupils toward determining the facts. All other questions are subsidiary to this, and depend upon it.

(4) Before beginning work in elementary science, learn what the pupils know upon the subjects to which the lessons pertain, unless you are already familiar with their previous work. A good exercise for determining this fact is to ask the class to write from memory the names of the wild plants which they know, the names of the insects and the names of the animals, both wild and tame, with which they are familiar. An excellent exercise for determining the ability of pupils to observe closely is to give each member of the class a small box of seeds of different varieties to sort, such as a dozen grains each of wheat, barley, oats, buckwheat or other seeds that are easily obtained and which somewhat closely resemble each other. If you have never tried this exercise, doubtless you will be surprised at the numerous failures in separating the seeds into the groups in which they belong.

(5) See that the pupils apply what they have learned.

(6) Keep yourself in the background. In no other line of work is there such an opportunity for the teacher to become an adept in the rare art of keeping herself in the background, and probably in no other line of work is this so essential to

success. The teacher who would secure the greatest results from her science lessons must lead her pupils by suggestion, while they apparently take the initiative. This does not mean that the pupils should take the lead in planning and directing the work. At all times the teacher must be the controlling force, but her power should be so skilfully exercised that it is seldom openly manifest.

6. Material. Elaborate apparatus is neither necessary nor desirable. Nearly everything needed can be made by the pupils and the teacher, or it can be purchased at nominal expense. An opera glass with large lenses is a great help in studying birds, and if each pupil can have a small magnifying glass for the study of insects, small flowers and minerals, the class will be able to do some work that otherwise it might not be advisable to attempt. Conveniences for collecting and storing specimens should be provided. Jars, bottles and boxes can usually be obtained without difficulty or expense, and many articles can be made as they are needed. There should be enough mounted needles to go around the class.

Colored charts of birds and animals are helpful, and a reasonable expenditure for them by the school officials is wise. However, they should not be purchased at the expense of the school library or other equipment which is more generally useful. Pupils should provide themselves with notebooks in which to keep a record of their observations. It is a convenience in handling if these are all of the same size.

STUDY OF CORN

7. Introductory. This plan is designed for a comprehensive study of the corn plant. Those parts of the plan which require close analysis and the observation of minute details, such as pollination and the rate of growth per day, should not be used with the younger classes.

The corn plant is one of the best for study because it is so large that all its parts can readily be seen, because the children can plant the seed and watch the growth through all stages

from germination to maturity, and, finally, because from an economic viewpoint corn is our most valuable agricultural product.

From necessity, the lessons will be given at intervals, probably about once a week. At each lesson definite things should be decided upon for study before the next lesson, at which all observations should be reported. The last lessons of the spring or summer term should leave the pupils well prepared to carry on observations by themselves during the long vacation.

8. Planting.[1] (a) Preparation of Soil. Before planting in the field or garden, give a series of lessons on the conditions necessary for the successful growth of the crop. First, discuss the kind of soil best suited for corn. In the locality in which you are is corn more generally planted in the valleys, along streams or on the higher land? What do you know about the amount of moisture it requires?

After the discussion of the soil best suited to the crop, take up the matter of preparing the seed bed. What sort of preparation does the soil need? The answer of this question leads the pupils to see the necessity of using fertilizers, to determine whether deep or shallow plowing is the better, and what should be done to the soil after plowing, before the crop is planted.

(b) Time. What is the proper time for planting corn? Why is corn usually planted later in the season than oats, wheat or potatoes?

(c) Selection of Seed. If your school is located in a region where corn is generally grown, have each pupil bring

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[1] If the pupils have not studied the germination of corn, plant in window boxes enough to supply the class and study at frequent intervals until the plants reach the surface.

If the pupils have never studied germination, plant in other boxes or the school garden, beans, peas, squash or cucumber seed and onion seed. Fill several glass fruit jars with water, place some cotton batting on the water and upon it place a few seeds of each kind. Place others between sheets of moist blotting paper and cover with a plate. Watch the progress of these three groups of seeds from day to day and observe the different plans of germination.

to the class an ear of the best corn which he can procure. If all ears are satisfactory, let each pupil select his seed from the ear which he has brought, or if the pupils prefer, let them exchange ears and then select seed. Discuss this selection carefully, leading the pupils to see why the kernels should not be taken from the tip or the butt of the ear.

(d) IMPLEMENTS. In planting the corn in the school garden or the home garden, what tools are used? If the farmer has a large field, what machine does he use? Why? These questions will lead to the discussions of various tools, doubtless ending with an explanation of the working of a corn planter. Pupils living in a corn-growing region are familiar with these implements, and with them much of an explanation will not be necessary.

(e) PLANTING THE CORN. When all preparations are made, ask the pupils to plant their corn. How deep should the seed be covered? Why? How far apart should the hills be? Why? If you have a school garden, the study should center around the corn planted there, and as much space should be devoted to the crop as will be necessary to enable the class to have all the corn they will need for study. Probably from ten to twenty hills will be ample. This, of course, can be determined by the number of pupils in the class. In addition to the corn in the school garden, each member of the class should plant a small patch in the home garden, at least from six to ten hills. The older boys should be encouraged to plant as large a patch as they can care for. Each pupil should be asked to plant one hill at least one hundred feet from any other corn. After the plants have started, this hill should be thinned to one stalk, and it should be as carefully cultivated during the season as the others.

9. The Growing Plants. Study should begin as soon as the corn appears above ground. Lead the pupils to see the manner in which the leaf is rolled and to watch the plants from day to day, so they may discover the gradual unfolding of the leaves. It is well to have sketches made of the plants

when they first appear above ground and again after about a week. (The accompanying illustration is that of a young plant.) These drawings should be made in a notebook in which all other corn observations are recorded. Do the new leaves start above or below the old leaves? How are the leaves attached to the stalk? (They form a sheath covering nearly the entire joint from which they spring.)

At the second examination it is well for each pupil to have a plant before him, but all further study should be confined to the growing plant where it stands.

The study of the stem naturally follows that of the leaf. A few questions will lead the children to see that the stem is slightly concave on one side, that the new shoots are smooth and the older ones rough because of the enclosing sheath, and that the stalk is jointed and enlarged at the end of each joint. They will soon discover also the different colors, varying from green to dark purple. How does the stem increase in length? Does it grow from the upper joint only or do all the joints grow? Which part of each joint grows? Why does the leaf sheathe this part? Why is this point tender? How does it taste? Why? How can you ascertain these facts? These problems will lead the class to see that they must make very careful and systematic observations. If the pupils are asked to measure the different joints in the stalk at regular intervals and keep a record of these measurements, they will be able at the end of the season to tell just how much each joint increased in length and also at what time in the season the growth was the most rapid.

Such a record is easily kept. Have the pupils select a number of stalks to be measured and fasten upon each of these, in a manner that will not injure them, a little numbered tag, as 1, 2, 3. Number the joints from the bottom upward as they develop. Having done this, the record can be kept on a page of the notebook ruled in this manner:

GROWTH OF JOINTS IN INCHES

STALK I														
DATE	JOINT 1		JOINT 2		JOINT 3		JOINT 4		JOINT 5		JOINT 6		TOTAL	
	Length	Growth	L.	G.	L.	G.	L.	G.	L.	G.	L.	G.	L	G.
6/1	8		6		5								19	
6/8	8½	½	6¾	¾	6¼	1¼							22½	3½
6/15	8⅞	⅞	7⅞	⅞	7¾	1½	1¾	1¾					30	7½

Since successive joints are added as the stalk increases in length, the later observations will contain a number of joints that do not appear at first. Construct a similar table for each stalk measured. At the end of the lesson compare the tables and see if you can tell why one stalk has grown more than another.

10. Tillage. When the plants are about six inches high, ask the pupils what must be done to them. What tools shall be used for this purpose in the garden? If the farmer has a large field, what does he use? Why? Why is tillage necessary? Doubtless all the pupils will see that the crop is cultivated to kill weeds, but it is quite probable that only a few, if any, understand the necessity of cultivation for the purpose of conserving moisture. This fact should be dwelt upon until all members of the class understand how the earth mulch prevents evaporation. A third reason is that plants throw off waste matter, poisonous to themselves. Cultivation makes the soil porous, and thus assists in oxidizing this matter, which, if allowed to accumulate in the soil, is injurious to the plant.

After the first tilling, the class should observe the plants from day to day, and the time for the second tilling should be determined upon in class, as far as possible. This is easily settled for the corn in the school garden, but home crops may vary so widely, because of conditions of soil and moisture, that it will be necessary to till some sooner than others.

As the season advances, the time to cease tilling should be determined upon. Ask the class why it is better to "lay the crop by" at this time. In answer to this question you should obtain the following facts: In fields where cultivators are used after the plants are half grown, the teams break the leaves, and, a still more important reason for ceasing tillage at this time, the cultivator disturbs the roots and reduces the productivity of the plant.

11. Flowers and Fruit. The pupils should be directed to watch for the appearance of the ears on the plant. Ask them to notice from what points on the stalk the ears grow and by questions lead them to see that the ear is an altered branch. Which ears appear first?

When the ears are formed, have each pupil break one from his plant and bring it to the class. Study the parts. Notice that the bracts, or husks, as they are commonly called, are altered leaves. Call attention to their arrangement on the shortened joints of the ear. Notice how they differ from the other leaves of the plant. What purpose do they serve? The husks overlap each other so as to protect the seeds from water and from birds.

Strip the husks from the ear carefully, so as not to disturb the silk. Have the pupils trace these fine, hair-like organs from the end of the ear to the point from which they started. In doing this the children will discover that each thread of silk is joined to a rudimentary kernel. Tell the children that the silk is a hollow tube with an opening at the outer end which is exposed to the air. Why are these outer ends so sticky?

Following the study of the silk, study the tassel. Note the difference in structure between the tassel and the silk. The tassel is made up of spikes of staminate flowers. The ear is a single spike of pistillate flowers, each thread of silk being the style of a single pistil. The pupils will need to watch the development of these two sets of flowers and to notice how the pollen is scattered. When they discover this they can tell why the ends of the silk are sticky. What

would be the effect if all the tassels were cut off before the blossoms opened? The study of pollination should seldom be carried beyond the point of the contact of the pollen with the silk. The other part of this process requires too minute study for children.

12. The Complete Plant. Lessons on the complete plant should be given soon after the opening of the fall term. The class should have before them several of the best plants that they have grown, taken from the ground so as to preserve the root system as completely as possible. This can be done by digging around the plant with a spade, lifting it bodily from the ground, gently loosening the soil around the roots and rinsing off the adhering particles. In connection with these stalks each pupil should also bring one of the stalks which he planted far from the others.

(a) BEAUTY. Notice the plant as a whole—its long, straight stem, its curving dark green leaves and its ears hanging gracefully down, which make it one of the most beautiful of plants. The many beautiful designs for decoration which can be made from corn should also receive attention. Encourage the pupils to invent designs and decorate the schoolroom with corn. After this is done, have a harvest festival and invite the parents.

(b) MEASUREMENTS. Measure the height of each stalk before the class. How many days between the date of planting and the day on which the plants were taken from the ground? What has been the average growth in inches per day?

If convenient, have the plants weighed. At the average weight of these specimens, how much plant food is taken from the soil by an acre of corn? This problem can be solved with sufficient accuracy for all practical purposes in the following manner: Have the pupils cut into small pieces the stalk that has been weighed; place these in a skillet with a loosely adjusted cover, and heat over a fire until nothing but white ash remains. Then weigh the ash. The difference in weight approximates quite closely the weight of matter which the

plant extracted from the soil. Have the pupils count the stalks on a patch one rod square; then multiply this number by the number of square rods in an acre, and multiply the product thus obtained by the weight of the matter extracted from the soil by a single stalk. When they have solved this problem, the pupils will realize as never before the value and necessity of fertilizers.

With mature classes the sources of food and the means by which this food is taken up and assimilated by the plant can be discussed with profit, but the teacher who would attempt this must have a reasonably thorough understanding of plant physiology, for the lessons will give rise to questions which, without such knowledge, she will be unable to answer.

(c) THE ROOT. Notice the extent of the root system, but in connection with this impress upon the pupils the fact that not all of the roots are attached to the specimens, since in their reaching out for nourishment the finer roots extend for several feet in all directions, and in removing the plant from the ground these are cut off. How do the roots compare with one another in appearance? Do any roots start from the stalk above ground? If so, what is the special use of these roots? Why is the stalk so large at the bottom? The answers to these questions will lead the pupils to see the adaptation of the plant to the strain that is placed upon it in case of a high wind or storm.

THE CORN PLANT

(d) THE STALK. Study the structure of the stalk. Cut one or more of the stalks across, so as to expose the cross-section, and split one or more of the others lengthwise. Notice the different parts—rind and pith. The difference between these parts is that in the rind the bundles of fibrous tissue are smaller and closer together than they are in the pith. Compare the cross-section of the stalk with the cross-section of the branch of some tree. Lead the pupils to see that the stalk contains bundles of fiber scattered through the pith, but that its great strength is in the outer walls, while the branch of the tree is constructed on an entirely different plan. The corn is an inside grower, or *endogen*, while the branch is an outside grower, or *exogen*, because the new wood comes outside of the old wood, though beneath the bark. Why is the stalk so porous on the inside, and why is it solid at the joints? The answers to these questions lead to the principle in physics that a hollow tube has greater strength than a solid rod containing the same quantity of material, as a stove pipe six inches in diameter will sustain a greater weight without bending than an iron rod of the same length containing the same amount of iron. The solidity at the joints prevents the stalk from being easily bent or crushed; hence, in the combination of these two principles the greatest possible strength is given the stalk for the amount of material that it contains.


THE EAR

13. The Ears. How many ears on a stalk? How many on the stalks that were planted away from the others? How do the ears on these stalks compare in development? Now break the ears from the stalks, strip off the husks, and compare the ears. Count the rows of kernels. How many in each ear? Are all the ears equally well filled? If any are defective, what is the cause? The answer to this question will lead to a review of the planting, tillage and other conditions of growth during the season. Out of this discussion

ROOTS OF CORN

Photograph from Wisconsin Agricultural Experiment Station, Madison, Wis.

the pupils should see that those plants which had the best care, other things being equal, produced the best ears.

14. Varieties. After the class has made a thorough study of the plants with which they began, you should take up and discuss with them the different varieties of corn. Let them procure all the different kinds they can in the neighborhood. Doubtless they will be able to bring specimens of sweet corn and, in some localities, of popcorn. When all these collections have been made, the different varieties should be compared as to color, size, structure, and the length of time required for the plants to reach maturity.

After these questions have been settled, you should add the names and descriptions of such varieties as the pupils have not been able to obtain and lead them to see that each variety is specially adapted to the locality in which it is grown or the purposes for which it is raised. For instance, the large dent corn succeeds only in that portion of the United States which has long, warm summers, while the flint, or hard yellow corn, will mature as far north as the central part of Minnesota, and has always been the corn grown in the New England states. This variety succeeds in these localities because it does not require so long a season. Sweet corn is specially adapted to be eaten green and also for canning, while popcorn is grown as a luxury.

15. Where Grown. Under this topic the geography of the corn region of the United States should be discussed and the pupils should understand what the great corn states are, also that corn is grown to a greater or less extent in every state in the Union. Following this, notice its cultivation in other countries, particularly in southern Europe, northern Africa and in Asia.

16. Uses. (a) HUMAN FOOD. Under this head discuss the manufacture of corn meal and the different articles of food prepared from it, such as corn bread, hominy and mush. The next important product is corn starch, in the manufacture of which several million bushels of corn are used

each year. Numerous breakfast foods are also prepared from corn.

(b) FODDER. Lead the pupils to see that in the states where the most corn is raised, large numbers of cattle and hogs are fattened from fodder in the form of stover, and that it is especially valuable for feeding milch cows. This will lead to the study of the process of preparing this fodder by chopping it and placing it in air-tight enclosures called silos.

(c) OTHER PRODUCTS. The other uses of the grain are the manufacture of glucose or corn syrup, alcohol and other distilled spirits and corn oil. From the oil a variety of vulcanite, or corn rubber, is made.

(d) STALKS. The stalks are often used dry by farmers for fodder for cattle, and the pith is used in the manufacture of smokeless powder and for packing beneath the armor-plate of battleships. If a ball pierces the armor, the cornstalk pith swells and fills the opening so that the entrance of water is largely prevented. Other portions of the stalk are valuable in the manufacture of paper. The husks are used for the manufacture of paper, for filling mattresses and for packing fruit and other articles. In localities where corn is raised in large quantities and coal is scarce, the cobs are often used for fuel. Thus all parts of the plant are of value to man, and because of the great variety of uses to which it can be put corn is one of the most valuable of all the agricultural products.

17. Classification. Compare the complete plant with complete plants of wheat, oats and timothy or other grasses, for the purpose of having the pupils notice the points of resemblance in the general structure and manner of growth of these respective plants. By directing their attention to the structure of the stems, the way in which the leaves form sheathes around the stems, the general resemblance of the leaves and the joints in the stems, you should lead the pupils to see that in general structure all these plants resemble each other so closely that they must be members of one family.

All are grasses, but corn differs from the rest in having stamens and pistils on separate parts of the plant.

18. History. These lessons should bring out the facts that corn is a native of the warmer portions of America; that it was first made known to white men by Columbus, who, on the return from his first voyage, carried specimens of it to Spain; that for centuries it had been one of the chief articles of food for the American Indians and that the most advanced tribes, especially those in Mexico, were successful in its cultivation; that it was for many years one of the chief sources of food of the early colonists, especially in New England; that its development and perfection have been due to cultivation by white men, and that soon after its discovery in America it was introduced very generally into the countries of northern Africa and from there into Asia. The nations in southern Europe did not begin the extensive cultivation of corn for a long time after it was introduced into Spain by Columbus.[1]

19. Literature. The lessons on history afford the best opportunity for introducing the literary selections bearing directly upon corn. The most important of these are the Indian legend of the origin of corn, as told in *Hiawatha* (see "Hiawatha's Fasting" and "The Feast of Mondamin" in the poem). Following this are Whittier's *Huskers* and *Corn Song* and Celia Thaxter's *Maize for the Nation's Emblem.* These poems, at least, should be studied at this time, and selections from other writers can be used if time and opportunity afford. (See Section 3.)

20. Economic Study. The corn crop of the United States amounts to about 2,200,000,000 bushels each year, or four-fifths of the entire crop of the world. Were the corn of the United States all gathered into one huge pile, it would fill a trench thirty-five feet wide and thirty-five feet deep and extend from New York City to a point fifteen miles west of Buffalo.

[1] In Europe generally, the word *corn* is applied to wheat and other cereals, the name *maise* being given to Indian corn, from the Indian word *mahys*.

Harvesting the corn and preparing it for market require the labor of the entire rural population of the great corn-producing regions for several weeks. Harvesters which cut the stalk from the roots, break off the ears and husk them are now in use, though the greater part of the harvesting and husking is still done by hand. From agricultural implement dealers, you can get pictures of the different corn harvesters, if the children are unable to see the machines.

After husking, the ears are placed in cribs, which are long, narrow sheds, having their sides made of narrow boards with openings between them for the passage of air so that the corn can readily dry. When dry, the corn is shelled or thrashed by machines driven by steam or gasoline engines. One machine will shell from 2,500 to 4,000 bushels a day. Only shelled corn is marketed. This is placed in local elevators or shipped to the great trade centers, such as Chicago and Buffalo, where it is stored in large elevators until needed.

A bushel of shelled corn weighs 56 pounds. The largest freight car will carry 60,000 pounds. How many cars will it require to move the entire crop of the United States? Allowing 40 feet to a car, how long a train would these cars make? At 50 cents a bushel, what is the value of the crop? Learn from the latest crop reports the number of bushels raised in the leading corn-producing states. Have the class draw a map of the United States and locate the corn belt upon it, then write in each state the number of bushels produced.

21. Applications. This plan can be used to study wheat, cotton, rice, oats, barley, flax, beets, potatoes, and all other important agricultural plants, with only such modifications as the difference in the nature of the study of the plant requires. The pupils should be able to use this entire plan, and before they leave this grade they should acquire a fair knowledge of all the great farm crops. (See *Coal*, Volume One, pages 287-289, Section 8.)

Such plants as the violet and the morning glory are much simpler and require less detail; they are therefore suited to

the work with younger classes. The sunflower, the dandelion and other composite flowers should be studied by the older pupils.

Each class should study a few new plants each season. The plants should be selected and the work so planned as to have each series of lessons take up plants that are more complex and include more details of the plan, until the highest grade is reached. By making selections to include the most important families of plants, namely, the Crowfoot Family, the Rose Family, the Mustard Family, the Pulse Family, the Composite Family, the Mint Family, the Violet Family, and the Lily Family, the pupils when through the grammar grades should know the most prominent characteristics of these Families, and be able to recognize and name several plants belonging to each. With the older pupils the adaptability of plants to the regions they occupy should be brought out. A grass grows quickly, comes to early seeding and dies. These peculiarities make grasses the characteristic vegetation of regions of spring rains and long, dry summers, as forests are characteristic of rainfall well distributed through the year. When these facts are understood, the pupils can readily give the reason for grassy plains or forests in any particular region of the world.

22. Aids. The following books are helpful for both teacher and pupils:

Corn Plants: Their Uses and Ways of Life. Sargent. 106 pages. Houghton, Mifflin & Company. This is a concise history and description of the cereals used for food. The illustrations are numerous and helpful and the text contains much valuable and interesting information.

Great American Industries, volume on *Products of the Soil.* Rocheleau. 200 pages. A. Flanagan Company. This volume contains chapters on lumber, sugar, cotton, corn and wheat. Each chapter is a good type study of the subject treated.

By the same author, *Geography of Commerce and Industry.* 416 pages. Educational Publishing Company. This work treats of the chief agricultural products from economic and commercial viewpoints, and gives much information that all pupils should receive. The illustrations show the most recent methods of handling the products described.

Special Method in Elementary Science. C. A. McMurry. This work contains an excellent lesson on corn as a type study. For full description, see page 67 of this volume, Section 45.

The teacher should have the following publications from the United States Department of Agriculture:

Farmers' Bulletin No. 298, *Food Value of Corn and Corn Products.*

Farmers' Bulletin No. 80, *Corn Culture in the South.*

From the Illinois Agricultural Experiment Station, Urbana, Ill., obtain Bulletin No. 87, *The Structure of the Corn Kernel and the Composition of its Different Parts.*

Bulletin No. 96, *The Testing of Corn for Seed.*

Bulletin No. 100, *Directions for the Breeding of Corn.*

Bulletin No. 113, *Shrinkage of Ear Corn in Cribs.*

Also from the Agricultural College Extension Department, Urbana, Ill., the pamphlet entitled *Studies in Corn and its Uses.* This is especially valuable for the information which it contains about corn products and for plans for specific study of different parts of the plant.

From the Iowa Agricultural Experiment Station, Ames, Iowa, procure Bulletin No. 77 of the Agronomy Section, *Selecting and Preparing Seed Corn.*

All bulletins published by the United States Department of Agriculture can be obtained free of cost by addressing the Secretary of Agriculture, Washington, D. C. Bulletins of state experiment stations are free to all within the state in which they are published, and most stations send them to teachers in other states free of charge. If any charge is made, it is merely nominal. For state bulletins address the director of the agricultural experiment station of the state in which the bulletin is published.

THE STUDY OF BIRDS

23. Value. Birds, with their beautiful plumage, elegant shapes, graceful motions and sweet songs, are always a delight to children and to such grown persons as have had their souls opened to the charms of nature's most beautiful creation. In school work nothing can be more inspiring, and nothing better calculated to bring the teacher and pupil into ready sympathy, than an enthusiastic inquiry into the lives and habits of our friends of the air. Besides training the eye to

observe quickly, the mind to perceive accurately, to classify and to judge, bird study gives the finest training to the aesthetic and unselfish emotions. Admiration for the beautiful forms and charming ways of the birds grows rapidly into love for them and sympathy with the hardships of their existence.

24. Time. There is no time during the school year when the study of birds cannot be made interesting. After the Christmas holidays the teacher may give occasional lessons in bird structure, teach the principal parts of a bird and assist the pupils to identify the permanent residents. This will take up the time approximately to the first of March. From then until the middle of May, a few minutes may be given daily, for the transient visitants and the summer residents come thick and fast. Bird songs, nesting habits, young birds and kindred topics occupy the time till the close of school in June. The autumn migration comes with the opening of school; but autumn and early winter may better be given to studying the relation of birds to man. (See pages 103-106, Section 42.)

25. Structure. For studies in structure and parts, a living bird is desirable in the schoolroom. A stuffed specimen is good, and its lifelike appearance will give zest to the study. A bird skin, however, will answer the purpose. If a dead bird is used, it should be treated with respectful tenderness by the teacher and handled gently by the pupils. There will be no difficulty in getting a specimen for study, if the pupils watch for it. In default of a better specimen, a pigeon or a chicken will answer well. Don't ask any pupil to kill a bird. Perhaps, however, you can have an English sparrow killed; but do not use the specimen if it is bloody or disgusting in appearance, unless you wish to create repugnance and point a lesson in kindness. With specimen in hand, study it from the plan given on pages 26-29. You ask the questions and let the children answer from examination of the bird. Encourage them to find out or to see that the answer is not yet determinable.

Do not carry the study too far with the class nor allow it to drag. Ten minutes is a long time for such a study as is outlined, if you become familiar with the form. Apply it to many birds, and always compare. Teach the pupils to study living birds (as many as possible) at home and in the field. The pigeon, hen, turkey, duck, goose, canary bird, parrot, blue jay, robin, woodpecker, chickadee, crow, and English sparrow, at least, may be studied almost anywhere.

26. Teacher's Preparation. The teacher should have a much more extended knowledge of birds than it is possible for her to present to the class, because this additional knowledge will enable her to answer many questions and give interesting information which would be impossible without it. The following diagram and outline, therefore, are given for the express purpose of guiding the teacher in her study. The diagram can be used with the class for the purpose of teaching the children the prominent parts of a bird, such as head, beak, crown, neck, throat, back, breast, wings, upper tail coverts, under tail coverts, primaries and secondaries. With beginning classes only the parts first named should be considered. The outline should not be used with the pupils; let them study after the plan given under *Field Work*, Section 31.

I. HEAD. Size? Shape? Height of forehead? Crest? Carriage?
   1. *Bill.* (Two mandibles.) Length? Width? Height? Shape? Tip? Nostril? Marks? Does the opening between the mandibles extend back beyond the base of the bill? Tongue?
   2. *Eye.* Position? Shape? Arrangement of feathers around it? How many lids? (Three.)
   3. *Ear.* Position? Arrangement of feathers?

II. NECK. Length? Carriage?

III. BODY. Shape? Size and shape of breast? Back? Length? (The length of a bird is the distance from the tip of its bill to the tip of its tail when the bird is lying flat on its back with its bill stretched backward.)

IV. WINGS. Joints? (Three.) Position of feathers? Length of outstretched wing to tip of feathers? (Compare the length of the bird with the distance from tip to tip of outstretched wings.) Are the wings straight or curved?

V. LEGS.

1. *Upper Joint or Thigh.* (Does this extend outside of the general skin that covers the body?) Length? Do feathers cover it entirely? What portion is exposed?
2. *Middle Joint* or *Tibia.*
3. *Tarsus.* Length? Round or flattened? Feathered? Scales? (Compare the front with the back.)
4. *Toes.* Number? Position (on a level? Do they point forward orback?)? Joined or free? Webs or appendages? Nails (Number? Shape? Length? Character?)?

VI. TAIL. Length? Breadth expanded? Shape of end? (Compare outer and inner feathers.)

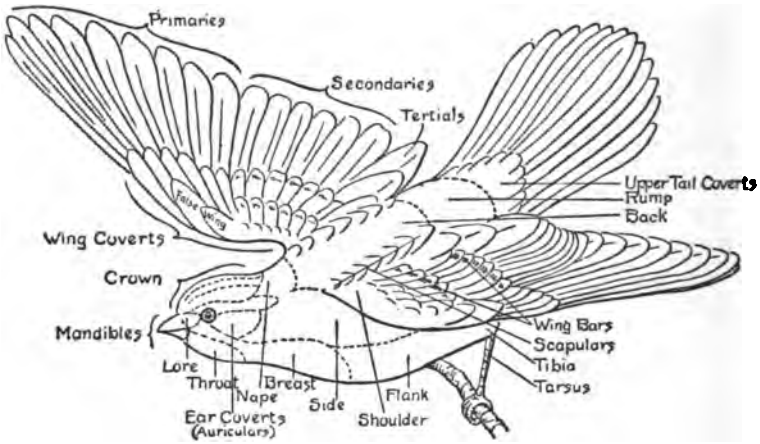
VII. FEATHERS. Color? Shape? Shaft? Vane? Symmetry? (Are the two sides alike?) Character (Rigid? Flexible? Soft? Satiny?)? (Select feathers from different parts of the body so as to get as great a variety as possible. Try to draw out the reasons for differences in shape and character of feathers on the different parts of the body.) Where are pin-feathers?

27. Written Exercises. The older pupils may be asked to copy the outline (Section 26) without questions and then to make a report on each bird they study by writing in the answers to the questions.

Require also written reports of these observations in your language classes. Teach the pupils to follow the outline, in order to have a logical arrangement, but to write smooth essays and to illustrate them by outline drawings of the bills and feet, at least.

28. Parts of a Bird. In describing a bird for identification, certain areas of the body are given specific names which may be learned from the diagram on page 24.

This may be placed upon the blackboard; pupils may copy it in their notebooks and then by drill lessons they must learn the words and be able to locate the areas instantly. While a complete diagram is here given for the benefit of the teacher, the attention of the class should be called to the



PARTS OF A BIRD

most prominent parts only, as head, breast, wings, tail. There is danger that the inexperienced teacher will attempt too minute an analysis.

29. Classification. Birds may be separated into two great groups: first, those that live wholly upon land; second, those that live wholly upon the water or upon land and water. In most schemes of classification the water birds are placed first and are themselves separated into nine Orders. The land birds, which are grouped in eight Orders, comprise more numerous species and are the most easily studied. In determining to what Order a bird belongs, its bill, legs and feet are the things to be first noticed. In fact, by these alone most birds can be quickly assigned to their proper Order.

30. Land Birds. Land birds may quickly be classified into Orders by the following brief table:

Scratchers. Turkey, Grouse, Bobwhites. (Fowls.) Bill generally short, stout, hard and horny. Toes 4; hind one small, elevated above the front ones. (Live chiefly on the ground.) (Fig. 1.)

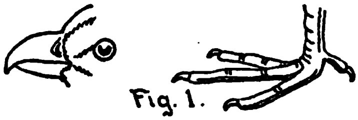


Fig. 1.

Pigeons. Pigeons and Doves. Bill rather slender, deeply grooved. Nostrils in a soft, fleshy membrane (cere). Toes 4, on a level; hind one as long as the shortest front one.

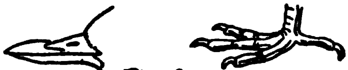


Fig. 2.

Birds of Prey. Vultures, Hawks and Owls. Bill very stout and strong; upper bill with a sharply-pointed hook. Toes 4, 3 in front; all armed with strong, sharp, curved nails. (Figs. 3 and 4.)

Fig. 3

Fig. 4.

Parrots. Bill strong; upper mandible projecting and strongly curved; cere. Toes 4, 2 in front and 2 behind. (Fig. 5.)

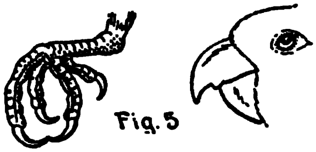


Fig. 5

Cuckoos and Kingfishers. Bill without a cere, straight or slightly curved. Toes 4, the middle and outer ones joined for half their length (kingfishers); or, 2 in front and 2 behind (cuckoos). (Fig. 6.)

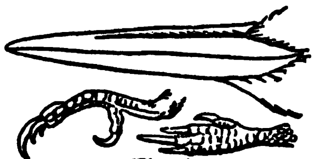


Fig. 6.

Woodpeckers. Bill strong, straight. Nostrils more or less covered by bristles. Toes 4; 2 in front, 2 behind. Tail feathers stiff and pointed. Climb trunks of trees. (Fig. 7.)

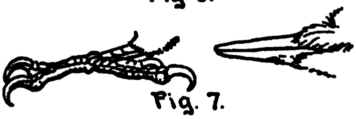


Fig. 7.

Swifts and Hummingbirds. Bills short, small, and mouth large; or, bill long and exceedingly slender and mouth small. Feet very small and weak. Seen almost entirely in the air. (Fig. 8.)

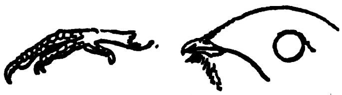


Fig. 8.

Perching Birds. Bills various. Toes 4, without webs; all on the same level; hind toe as large as the middle one; nail generally longer than that of the middle one. (Fig. 9.)

Fig. 9

Among land birds the perching birds compose the great Order, and it is well to know the characteristics of the eighteen Families that compose it. These characteristics, however, may be learned as birds are identified one by one.

31. Field Work. The study of birds is preeminently an outdoor study and need not take much time from other school studies. The reports, the brief discussions, may be for the classroom; but the real work is done on the Saturday excursions, the Sunday walks, the trips to and from school and at recess and the noon intermission. When pupils have once been shown the charm of bird study, their sharp eyes will find material enough. If the teacher will but show a little enthusiasm herself, will only go out with the pupils and see, study and admire, all will be drawn together by a common interest, and the routine of the school will be much lighter.

In looking for birds, wear quiet clothing, especially avoiding white; go slowly and quietly; stand still and wait often for the birds to move. Keep the sun at your back, if possible, so you can be sure of the colors. Cloudy and rainy days are good, for birds never stay indoors long at a time. Early morning (before 7 a. m.) and late afternoon are the best times of day. But there are always some birds to be seen at any time. A good opera-glass is of great assistance, but it is not essential. Be *sure* in your sight or say frankly, "I don't know." It is very easy for anyone to be deluded into thinking that he sees what he expects to see.

32. Observations. It is always best to carry your notebooks with you and to record your observations on the spot where you make them. It is the easiest thing in the world to forget what you saw in those few exciting moments when you looked at the bird flitting about in the underbrush. Acquire the habit of making your notes systematically—setting down or remembering in order the facts you will need in identification. The following are the main points:

(a) SIZE. The size of a bird is his length. (See Outline, in Section 26.) Use a familiar bird as a standard—the crow, the robin or the sparrow. The English sparrow is 6 inches

BIRD STUDY
Photograph by Miss R. B. Fisher, Vergennes, Vt.

MAKING A SCHOOL GARDEN
Photograph by Miss R. B. Fisher, Vergennes, Vt.

long. You can, then, always put your bird into one of three classes: (1) Birds about 6 inches long; (2) birds decidedly less than 6 inches in length; (3) birds decidedly over 6 inches in length.

(b) HABITS. Notice carefully the sort of place the bird haunts—thicket, orchard, meadow, forest, swamp, etc. Watch the manner of flight, the place of lighting, the habit of feeding, the attitude when at rest, the motions of head, tail and body, the height from the ground at which the bird is seen and whether it is alone or with others. For the beginner, so many things may be confusing, but soon you will learn to recognize in a great many instances the Family to which a bird belongs, by his behavior. These facts will help you:

(1) *Woodpeckers*, alone or in pairs, climb up and down tree trunks, bracing themselves by their tails, heads up; *nuthatches* have similar habits, but are smaller, more erratic in their movements and often work head-downward; the *creepers*, about the size of a nuthatch, but more slender, usually work spirally up a tree from the bottom and then fly to the bottom of another.

(2) *Wrens*, alone or in pairs, are little brownish birds that flit in and out of crevices and bushes, carry their tails erect, and while singing perch on bushes in open sight.

(3) *Kinglets* are our smallest birds, restless and inquiring, that come early in spring, often in scattered groups.

(4) *Warblers* are gaily colored little birds, nearly always in motion in trees and bushes. There are many species that come in great numbers and rather late in migration, and after a few days most of them disappear to the northward.

(5) *Swallows* are usually seen flying in flocks in long, graceful turns near the water, by cliffs or about barns and houses.

(6) *Flycatchers* sit erect and watch for their insect prey, darting quickly and unerringly at it and then returning to the same or a nearby perch.

(7) Sparrows feed on the ground, often in large flocks, fly short distances only, and have thick, strong bills for cracking seeds.

(8) *Thrushes* run about alone on the ground, stopping suddenly to listen; some are very shy and keep to the dense undergrowths; others, like the robin and bluebird, are bold and confiding.

(c) COLOR. The male birds of most species are brighter than the females, though in some the sexes are colored alike,

and in a few species the female is the brighter. Moreover, the plumage of most birds varies greatly with the season, sometimes to such an extent that the species may not be recognizable in the unfamiliar plumage.. The young are often colored differently from the old, and some birds do not get their finest plumage till they are two or three years old.

When the male is known, you will know the female and young by their being associated with the male. They differ from the male in color, occasionally differ in size and usually in song. Watch carefully for any marked color patches (especially lines through or over the eye), eye rings, wingbars and white in the tail.

(d) NOTES. Birds have call notes, notes of alarm and, during the mating season, songs of joy. Listen carefully to what you hear and associate the note with the bird. Some birds sing while feeding, others never do; some sing while flying, as they start or as they alight; others are always silent when on the wing; some call loudly when alarmed, others slip quietly away without a note.

(e) PHYSICAL MARKS. The size and shape of the bill, feet and legs, the length of the wings and the tail, the shape of the tail and such other facts as may be recognized should be noted.

(f) DATE. The date at which you see the bird may help you greatly in the identification of the specimen, as the migrating birds are very regular in their appearance and departure. For instance, you may, if you live in the North Central states, expect to see kinglets in March, but no warblers before the middle of April.

33. Identification. You must not expect to make all the observations noted above on every bird; you will often have to content yourself with very few. But practice will enable you to see a great many things in a very short time; and in a majority of cases you can see enough to enable you to find the name of the bird in your book.

By far the best book for beginners in bird study is Chapman's *Bird Life*. Two excellent books for the identification

of birds are two little pocket manuals in limp leather, by Chester A. Reed.[1] The birds are arranged in natural order. Each page contains a picture of the bird in a characteristic attitude, with the conspicuous patches in color. Besides the picture, there is on the page a brief description of the bird, its notes, its nest and its range. These are the practical, usable books that every beginner ought to have. They should be in the school library, and every teacher who wishes to learn about birds needs a set. If you can get but one volume, get the one on land birds. (For other desirable books for the library, see Section 43.)

34. Permanent Residents. Every locality has its little list of birds that remain throughout the year. These may be best recognized in the winter, when they are alone except for the few winter visitors from the north. In the latitude of Chicago and east of the Rockies, the following birds are about all that remain the year round. To the north the number will be less, to the south, more:

Bobwhite	Long-eared owl	Crow
Ruffed grouse	Screech owl	American goldfinch
Red-shouldered hawk	Great horned owl	Purple finch
Red-tailed hawk	Hairy woodpecker	Song sparrow
Sharp-shinned hawk	Downy woodpecker	White-breasted nuthatch
Barred owl	Bluejay	Chickadee

The flicker and meadowlark remain in some localities, and in others the waxwing passes the summer and the robin and bluebird the winter.

35. Winter Visitors. In the latitude of Chicago and east of the Rockies, some or all of the following may be seen as winter visitors:

Snowy owl	Redpoll	Junco
Prairie horned lark	American crossbill	Northern shrike
Snowflake	White-throated sparrow	Winter wren
Lapland longspur	Tree sparrow	Golden-crowned kinglet
Brown creeper		

[1] *Bird Guide.* Part I, Water Birds, Game Birds and Birds of Prey East of the Rockies. Reed. *Bird Guide.* Part II, Land Birds East of the Rockies. Both are published by Charles A. Reed, Worcester, Mass., and may be purchased at 75 cents each of A. C. McClurg & Co., Chicago.

36. Migration. The birds begin to arrive from the south late in February or early in March. The first birds come as soon as the weather permits, regardless of date, but the later birds arrive year after year on almost the same day. The height of the migration comes early in May and by the end of the month the migration is over. We cannot give a definite list that will be accurate everywhere, but the following approximation for the arrival of land birds in the vicinity of Chicago will be helpful. Not all the birds are listed, but these are common type forms or birds that are easily identified. North or south of the latitude of Chicago the birds will appear a little later or a little earlier. The names in italics indicate the birds most easily recognized.

MARCH

FIRST HALF

Hairy woodpecker, *meadow lark*, *junco*, *song sparrow*, loggerhead shrike, *chickadee*, golden-crowned kinglet, prairie-horned lark.

SECOND HALF

Kingfisher, yellow-bellied sapsucker, *flicker*, phoebe, cowbird, *red-winged blackbird*, bronzed grackle, *American goldfinch*, fox sparrow, towhee, *cardinal*, brown creeper, white-breasted nuthatch, ruby-crowned kinglet, *blue-bird*, *robin*.

APRIL

FIRST HALF

Mourning dove, marsh hawk, sparrow hawk, white-throated sparrow, *chipping sparrow*, field sparrow, tree swallow, winter wren, hermit thrush, red-breasted nuthatch.

SECOND HALF

Red-headed woodpecker, *chimney swift*, kingbird, least flycatcher, vesper sparrow, white-crowned sparrow, *purple martin*, swallows (3 species), black-and-white creeper, warblers (10 species), *catbird*, *brown thrasher*, *house wren*.

MAY

FIRST HALF

Whippoorwill, *night hawk*, *bobolink*, *Baltimore oriole*, rose-breasted grosbeak, indigo bunting, scarlet tanager, vireos (5 species), warblers (20 species), *wood thrush*.

SECOND HALF

Cuckoo (2 species), *humming-bird*, orchard oriole, flycatchers (4 species).

37. Pupils' Records. The pupils will enjoy reporting the birds they have seen. On the bulletin board or blackboard may be placed in March a form like the following, which can be filled in from day to day till the end of May:

Name	Date	Observer	Remarks			
			Number	Where	Weather	Later Reports
1. Robin	Mar. 7	Jas. Fay	1	Tree at home	Warm and clear	First nest found Apr. 1. First young seen Apr. 10.
2.						
3.						
4.						

Encourage each pupil to keep for himself in his notebook from the first of March a daily record, or at least records of a day's observations as frequently as three times a week. The records of March may contain but three or four birds for each day, but in early May a good, bright boy may see from fifty to eighty different species in a day. After the leaves come out thickly and the migration passes, his list will fall off remarkably. The following is a good form for these personal records:

Daily Record, Saturday, March 27, 1909

(The birds marked * are those seen for the first time this year; those marked ** are identified for the first time.)

Weather. Cloudy and raw. Northeast wind.

Place. Northwest along Crooked Creek, to Smith's woods and return by way of Dead Pond.

Time. Noon to 5 P.M.

1. Downy Woodpecker—1.
2. Bluebird*—1.
3. Junco—10.
4. Prairie Horned Lark*.
5. Robin—3.
6. Song Sparrow—2.
7. Tree Sparrow—Big flock.
8. Loggerhead Shrike**—1.

These lists are written at the time the observations are made, though many pupils will wish to copy them neatly on their return and preserve them to compare with lists of another year. When new or unknown birds are seen, the

pupil will write his description in place of the name, and will try to identify the bird from the books at school.

38. Nests and Young. Late spring and early summer bring nests and young, and with them the almost irresistible inclination on the part of the boys to "collect eggs." Everything possible should be done to show pupils the cruelty and foolishness of this craze (the teacher will succeed better if she wears no bird plumage on her hat), to engender sympathy for the mother bird in her many dangers, and to inspire pleasure in watching the birds while they are nest-building and raising their young. The great variety, the structure and location of nests, the differences in color, shape, size and number of eggs furnish innumerable opportunities for good lessons full of *whys* and *wherefores*, in which teacher as well as pupil may watch and wait and learn from nature.

39. General Suggestion. We have attempted to give a general scheme for bird study that is applicable anywhere and at all times. In fact, it is a perennial subject which no teacher can exhaust in one grade or in one year. Year after year, as spring comes around, the interest in birds will revive, and every year both teacher and pupil will add to the list of their bird acquaintances. If a boy leaving the grammar grades knows sixty birds at sight, he may have done well. Yet we have known boys of fifteen from city schools who, rising at daylight, tramped many weary miles into the country almost every Saturday during the season and who haunted the parks before and after school all the week. They shouted with delight over every new bird seen or old friend recognized. A hundred and fifty species of birds these boys considered a good spring's work; in a single day they reported more than eighty. They had been taught a little about birds every year from the primary school up; every year their knowledge and enthusiasm grew. Children of the villages and country have much better opportunities, and with a little encouragement will be equally enthusiastic.

40. Bird Enemies. Difficulties in finding suitable places in which to build their nests, suitable material with which

to construct them and abundant food supplies for themselves and their young, are numerous and severe for our birds. Nevertheless, the active, wide-awake creature would conquer all these, even in many parts of our large cities, were it not for more direct and positive enemies for which we ourselves are largely responsible.

First and foremost among the birds' enemies comes the cat, whose natural instinct makes her most destructive among her natural prey. We have introduced the cat amongst the wild birds and left her free to prowl and hunt during the nesting season, while the young birds are defenseless and the old ones are driven by necessity to hunt for food, even in danger to their lives. It has been estimated that in the course of a year every cat allowed to run outdoors may be charged with the death of fifty birds. Probably the only thing that we can do in the matter is to set the children to watch, and encourage them to report the deaths they see. Perhaps in this way we can persuade them to select a better pet than the house cat, or at least to keep her indoors during the time the birds are nesting. If children will put into the nests where known, and rear when nest is not known, the helpless nestlings found on the ground, many lives will be saved.

Next to the cat, the English sparrow probably ranks as the greatest bird enemy. Not only do the sparrows seem to have a personal enmity against the wild birds and will join in mobs to repel the smaller ones, but from their habit of early nesting they seize upon the most valuable places long before our summer visitors arrive. While something may be said in favor of the English sparrow, yet every investigation proves conclusively that its chief food is that of its tribe and that it will neglect its opportunities among insects at any time to feed upon seeds and grain. Some sane and expeditious way of exterminating the sparrows should be devised.[1] In many places systematic efforts are being made

[1] The inquiring teacher will find considerable information in *The English Sparrow in North America*, Bulletin No. 1, United States Department of Agriculture.

to kill them off. Sometimes they are attacked during the nesting season and nests, eggs and young are heartlessly destroyed. True sentiment seems to prevent us from recommending any such course to pupils, and in fact it may be well to limit ourselves to encouraging observation and study of the English sparrow, his habits and his relationship to our birds, and allow his destruction to be carried out by other hands.

There are few states in the Union now in which there are not laws protecting the wild birds, and every teacher owes it to herself to know the laws of the state where she resides and to see that the pupils understand them thoroughly. These laws properly explained are usually quite sufficient to prevent the boys from making their predatory excursions or at least to keep them within bounds. However, the passion for hunting and collecting has not been so destructive to birds as have the dictates of fashion. More than one species of beautiful birds has been made practically extinct by man's greed and the feminine passion for adornment.

41. Attracting Birds. Most of the wild birds are naturally of a friendly disposition, and if not frightened do not seem to object to the presence of man or his work. There are many species of the most beautiful plumage that will readily come near our homes, even in large cities, if we can offer them coverts for concealment, attractive places to build, give them material to build with and assure them of food for themselves and their young. When they find these things many birds will build their nests even close to a railroad track or within sound of the roaring wheels of a factory.

Here are some of the things which we can do towards the partial domestication of our friends of the air:

(1) We can put up bird houses on the schoolgrounds and encourage the children to put up others at home. A few plans for these may be seen in the accompanying illustration.

(2) We may see that they have plenty of good, clean water from which to drink and in which to bathe. In the country this may not be so necessary as in the city; but

the nearer the water supply is to the house, the closer the birds will come. In the city, clean, shallow water is hard to find, and birds will go a long way to get it. A large pan

BIRD HOUSES

or dull-colored bowl with a roughish surface, in which are placed a few stones or something on which the bird may alight will, if it is filled every morning with fresh water, be almost sure to attract more than one beautiful wild bird.

(3) We can hang out bits of thread or string, pieces of cotton and hair for the birds that use such building material, and if we want the robins to build near our city homes we can see that mud is offered them.

(4) In the winter time we can fasten in the trees around the schoolhouses pieces of suet and encourage the children to do the same at their homes. In this way they may be fortunate enough to secure daily visits from more birds than they thought were to be found in such cold weather.

42. Birds in Literature. All literature is rife with allusions to birds, and our studies will serve to make our interpretation of literature much more vivid. In addition to this there are a great many poems, anecdotes and essays of high literary merit that treat of some bird or some phase of bird life. The interested teacher will not have far to go to find abundant examples of these in the school readers or in the works of our standard poets. In many of the states there are published from time to time bird-day and arbor-day annuals which give many beautiful selections and suggestions at greater length than can be given here. An inquiry addressed to the state superintendent will usually bring a ready and helpful response.

When a teacher has once acquired the habit of associating or correlating her work in science and literature, she will find how helpful to both is such a plan. The pupil who reads *The Birds of Killingworth*, *To a Waterfowl*, or *Robert of Lincoln* goes to his bird studies with renewed sympathy and interest. After having seen the bobolink "swinging on brier and weed" and listened to his sweet song, the pupil will return to his reading lesson with increased enthusiasm.

43. Teachers' Aids. (a) BOOKS. There are numerous finely illustrated descriptive books which relate to birds, but which belong rather in the domain of literature than in that of science. We make no attempt to mention these. The teacher will find the following books very helpful; if possible they should be placed in every school library and kept accessible for ready reference:

Bird Guide. Reed. (See Section 33.)

Color Key to North American Birds. Chapman and Reed. 300 pages. Doubleday, Page & Co. A rather large book, which includes all the birds of North America. They are grouped in Orders, then

the birds of each Order are arranged according to their coloring. Each bird is shown in characteristic attitude and his prominent color patches are rightly indicated. The *Bird Guide* takes the place of this volume east of the Rocky Mountains.

Bird Life. Chapman. D. Appleton & Co. A convenient book of about 300 pages. Simple in style; beautifully illustrated and contains excellent descriptions and a valuable key for identifying our common birds. This work is of great value to one beginning bird study.

Handbook of Birds of Eastern North America. Chapman. 418 pages. D. Appleton & Co. An illustrated book with a helpful introduction. Each bird is described in detail, and interesting facts are given concerning most of the species. This is an excellent book to use in connection with the *Bird Guide*.

How to Know One Hundred Wild Birds of Illinois; How to Know One Hundred Wild Birds of Indiana. These are two of several little books which retail at 50 cents each. They are published by the Educational Publishing Company, Chicago, and will be found somewhat helpful outside the bounds of the states they mention. They are types of many of the local bird guides and manuals which may usually be found at the important local bookstores.

Bird Homes. Dugmore. Doubleday, Page & Co.

(b) MAGAZINES. *Bird Lore* is probably the best of the ornithological magazines for school use. It is a small magazine published by the Macmillan Company at Harrisburg, Pa., and is the official organ of the Audubon societies. In each number is a directory of the Audubon societies and with the magazine come education leaflets which are of great assistance in school work.

TEST QUESTIONS

1. Why is a knowledge of the principles of the various branches of physical science more necessary now than it was fifteen years ago? Give an original illustration proving your statement.

2. Show by concrete illustration how the study of plants helps a pupil to become self reliant.

3. State the advantages of making a thorough study of some important plant according to the plan given for the

study of corn. What animals in your locality can be studied in a similar manner?

4. What are the advantages of having pupils keep systematic records of their observations in all science work? Make a plan for a record for observations on wheat or cotton.

5. Of what value is drawing in connection with the study of such subjects as corn and birds?

6. What facts of the plan for the study of corn can you use with the geography class? In what other ways can you illustrate the relation of elementary science to geography?

7. Describe the habits of the English sparrow under the following heads: (a) attitude when at rest; (b) mode of flight; (c) manner of moving on the ground; (d) place of feeding; (e) relation to other birds.

8. Write a brief essay, not to exceed 300 words, on the subject of *Bird Migration.*

9. In what ways may the study of birds be made to influence the character of boys and girls?

10. State prominent traits that enable you to distinguish sparrows from swallows; nuthatches from other creepers; wrens from kinglets.

LESSON THIRTEEN

ELEMENTARY SCIENCE (CONTINUED)

STUDY OF INSECTS

INTRODUCTORY

1. Reasons for the Study of Insects. Insects constitute by far the largest number of living creatures. A conservative estimate places the number of species at five million, but some authorities claim there are many more. On every hand, in all climes, insects abound. There is scarcely a plant or part of a plant that is not subject to attack from them, and some of them constitute the most troublesome pests with which the farmer has to contend. Some are injurious to man; many species are among the most beautiful and wonderful of living things. These facts and the ease with which they can be procured point to the study of insects as one of the most interesting and useful lines of work in elementary science.

2. Material Required. The study of insects is facilitated if each pupil has the following outfit:

(a) AN INSECT NET. Procure four or five feet of No. 12 wire from a hardware store. Bend it around a flower pot or some other cylindrical object so as to form a loop about a foot in diameter, crossing the wire six or eight inches from the end and giving it two firm twists. Clamp this loop into a vise and twist the ends closely together. Take a broom handle or any other stick of similar size and fasten the twisted end of the wire into this handle. Procure about a yard of tarleton or cheesecloth, and make a conical bag having a mouth the size of the loop. The bag should be at least two and one-half times as deep as the frame is wide, so that it will lap over easily when the insect is caught. With a little care and skill one soon becomes expert in capturing insects with this little apparatus, and it furnishes the children with a great deal of sport and outdoor exercise.

(b) An Insect Cage. This is easily made by taking a cigar box or crayon box and cutting out the whole or a portion of one side and covering this part with wire screen. Cut a piece of glass and slide it in in place of the lid, so you can watch the insects. A pasteboard box will answer the purpose, but it is not so durable. Insects can be kept in one of these cages and studied until all of the changes which they undergo can be observed.

(c) A Collecting Bottle. This is most easily prepared by procuring a wide-mouthed bottle and placing in it a small quantity of absorbent cotton, enough to cover the bottom to the thickness of an inch. Procure a vial of gasolene and pour a small quantity on the cotton. Keep the bottle corked. The vapor of gasolene is poisonous to insects, and they die almost instantly when placed in the bottle.

Caution. The vapor of gasolene is highly explosive, and both the collecting bottle and the vial of gasolene should be kept from artificial light and heat.

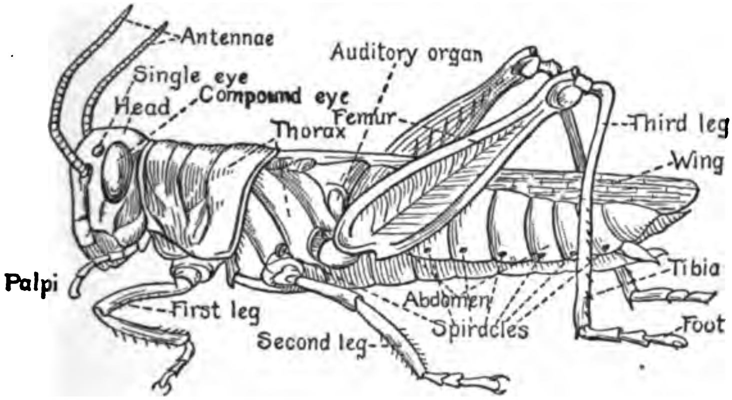
PARTS OF AN INSECT

3. General Structure. Insects are characterized by having their bodies divided into three segments—head, thorax and abdomen—each of which is distinctly separated from the others; by having three pairs of legs, all borne upon the thorax; and, in normal condition, two pairs of wings; however, one pair or both may be wanting. The blood is colorless or a greenish white, and the young are produced from eggs. A knowledge of their general structure is essential to the study of insects; therefore, the first work with intermediate classes should be the study of the parts of some insect easily obtained and of such size that the parts can be seen without the aid of a magnifying glass, though the use of the glass often adds much to the interest of the work. Dead specimens should be studied first, then living specimens of the same insect, for the purpose of seeing the working of the different organs.

4. The Diagram. The diagram here given is for the purpose of enabling the teacher to become familiar with the

structure and parts of an insect. The grasshopper is chosen because it is common and large. Before proceeding to the lesson described below, you should study the grasshopper in connection with the diagram until you can readily locate and recognize all the parts named.

5. Preparation. Previous to beginning the lessons, have the pupils collect and place in their insect cages several full-grown grasshoppers. The largest species obtainable are the best for study. The insects must be fed daily with grass,



PARTS OF A GRASSHOPPER

and this should be sprinkled with water once or twice each day. Before the lesson have each pupil take a grasshopper from his cage and put it in the gasolene bottle. After the insects are killed and have been aired a few moments, distribute them to the pupils.

6. The Insect as a Whole. Find the parts—head, thorax and abdomen. How are these separated from each other? How are they joined? How do the divisions of the body of the grasshopper compare with the divisions between like parts in the body of the cow, the dog, and the horse? These comparisons will bring out the fact that the divisions are much more distinctly marked in the grasshopper. Ask the pupils to examine other insects and ascertain whether or not this characteristic is true of them. Have them look up the

word *insect* in the dictionary and see why the name is appropriate.

Look at the appendages. How many pairs of legs are there? To what is each pair attached? How many pairs of wings? To what are these attached? Have the pupils lay the grasshopper on its back and with a dissecting needle bring the wings out until they are nearly at right angles with the body. This work is the most successful if each pupil is provided with a piece of cardboard and several pins, so that the wings can be pinned in position.

7. The Head. What is its general shape? Have the pupils hold the grasshopper in front of them so they may look directly at its face; then turn the insect so as to obtain a side view of the head. What projections do you find on the head? What are those on the upper part usually called? The common name *feelers* will probably be given in answer to this question. For this you may add the term *antennae*. Notice the projections on the lower part of the head. These are sometimes called the mouth feelers; the more technical name is *palpi*. Where are the eyes? How many are there? Do you consider them large in proportion to the size of the insect? Notice the two kinds of eyes, the large, compound eyes on the sides of the head, and the single eyes, *ocelli*, between the compound eyes. Children can find these without a glass, if their attention is directed to them.

Examine the mouth. Lift the upper lip with the needle and notice how it is joined to the head. Cut or break it off. This brings to view the jaws, or mandibles. By moving these with the needle, pupils can see how they work. Dissect the mandible with the needle very carefully and find the tongue, a brown organ, between them. Take off the lower lip. This gives a still more complete view of the mouth organs within.

After this study of the head has been completed, it is a good plan to have the pupils cut the head from another specimen, lay it upon a piece of white paper, face upward, and make a sketch of the face.

8. **The Thorax.** Notice the shield, or cape-like collar, forming the first segment and extending over the other. Remove this carefully and count the other segments. What organs are attached to them?

9. **The Abdomen.** Count the number of rings in the abdomen. Do all find the same number? Why can the grasshopper bend the abdomen? Notice the grooves on the under part.

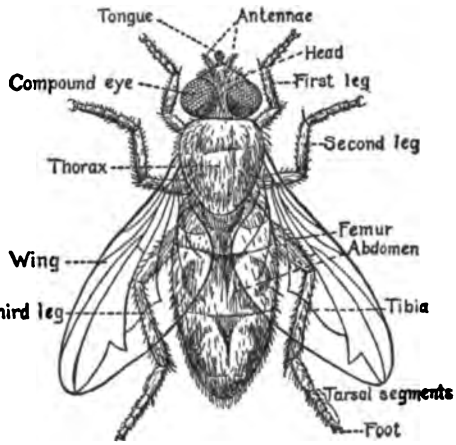
Just above the grooves notice the row of small openings. These are breathing pores, called *spiracles.* How many are there? Are any similar openings found in the thorax? Can you see how these work in the living grasshopper? Could you drown a grasshopper by placing only his head under water? Why? The discovery of these spiracles will raise several questions in the minds of the children. With a younger class it is not advisable to go into details in explanation, but with the older classes the explanation of the intricate air tubes can be undertaken.

10. **The Legs.** Compare the three pairs of legs as to size. Which is the shortest? Which the longest? How many parts can you discover in the leg? Do you know the names of the parts of the leg in the human body? The same names are applied to the parts of the insect's leg. Can you tell to which part each name should be applied? Why are the legs of the third pair so much larger and stronger than the others? Is this true of all insects? Several days will probably be required to obtain an answer to this question. In how many ways does the grasshopper travel? How does the grasshopper make a noise?

11. **The Wings.** In what position are the wings when at rest? Which pair folds over the other? Which pair is the larger? Of what is the framework of the wings composed? What is the position of the wings when in motion? For what are they used? Have the pupils make a drawing of the different legs and of the wings, also a drawing of the complete specimen, before the lessons end.

12. **Comparative Study.** Have the class examine in a similar manner the housefly, a butterfly, a moth and a May

beetle (commonly known as the June bug), and see how many parts they can find and identify. Each pupil should make a list of the parts found as he examines the insect. From these observations a few comparisons can be drawn. Do all the insects which you have examined have the same number of wings? How do the wings of the beetle differ from those of the grasshopper? Do all these insects move about in the same way?



PARTS OF A FLY

Why is the June bug, or May beetle, so called? Why are these beetles found only during a brief period each season? Do you know of any other insects of which this is true? Why do we have grasshoppers, flies, mosquitoes and some other insects all through the season?

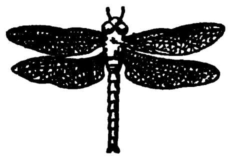
These questions should be given one at a time. After one has been answered to the satisfaction of both teacher and class, another can be given. Each question calls for careful and systematic observation, and it is not probable that the class will be able to answer them all in one season. If properly guided, the pupils will solve for themselves all problems to which these inquiries give rise.

LIFE HISTORY AND CLASSIFICATION

13. Metamorphosis. Through the observations necessary to answering the above questions, the children will discover that some insects, like the butterfly, go through four changes, the egg, the larva, the pupa or chrysalis, and the perfect insect or adult, being the forms in which they appear during

their existence; that others, like the chinchbug, undergo only partial changes, and that still others, like the grasshopper, appear from the egg in recognizable form. These changes are known as *metamorphosis*. An insect going through the four changes is said to have a complete metamorphosis. One having only a part of the changes has a partial metamorphosis.

14. Classification. Upon these distinctions and upon the number and structure of the wings, insects are divided into Orders and Sub-Orders. While a perfect classification has not yet been made, the following great Orders include all the insects usually met in the temperate regions. Classes in the grammar grades can learn the characteristics of each Order from observation, and after they have done this they should be able to tell the Order to which most of the insects common to their locality belong:



DRAGON FLY

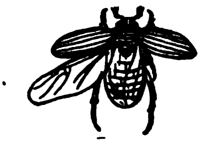
Dragon Flies, or *Nerve-winged Order* (Neuroptera). The insects of this Order have four membranous wings furnished with veins and numerous cross veins, giving them a net-like appearance. The larvae live in water and the metamorphosis is incomplete. All species feed upon other insects. The dragon fly and the ant lion are good examples.

LOCUST

Grasshoppers, or *Straight-winged Order* (Orthoptera). This Order includes grasshoppers, locusts, crickets and cockroaches; the wings of the second pair are flattened lengthwise and laid straight when folded. The metamorphosis is lacking, or incomplete.

CICADA

Bugs, or *Half-winged Order*. Many of the bugs have half of each wing in the first pair thickened like the wing covers of beetles, hence the name. The mouth parts are fitted for sucking. The metamorphosis is incomplete. The species are very numerous, and some, like the squashbug, the bedbug and the chinchbug, are well-known pests. The cicada is also a good illustration of this family.



MAY BEETLE

HOUSEFLY

MOTH

HONEY-BEE

Beetles, or *Sheath-winged Order* (Coleoptera). The beetles have an outer pair of hard wings called wing covers. The metamorphosis is complete and the larvae of some species are destructive. The May beetle, or June bug, is a good example.

Flies, or *Two-winged Order* (Diptera). The members of this order have only one pair of wings and these are membranous. The mouth is fitted for sucking or puncturing, and the metamorphosis is complete. The housefly, mosquito and gnat are good examples.

Butterflies, or *Scale-winged Order* (Lepidoptera). This order includes the butterflies and moths. Many of the species have large, showy wings, whose brilliant coloring is due to the feather-like scales with which they are covered. The metamorphosis is complete. The mature insect has a long proboscis, which, in the butterfly, is coiled when not in use. The larvae of some species are very destructive to vegetation.

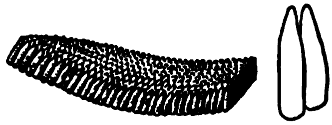
Bees and Ants, or *Membrane-winged Order* (Hymenoptera). This is one of the largest Orders and is estimated to include about one-fourth of the known species of insects. Bees and ants have four membranous wings, the first pair being the larger. Imperfectly developed females of some species have no wings. The metamorphosis is complete. Some species feed upon honey and others upon insects. This order includes the most intelligent and the most beneficial insects. Some of them, like the honey-bee, the wasp and the ant, live in colonies which have every appearance of well-organized communities.

THE MOSQUITO

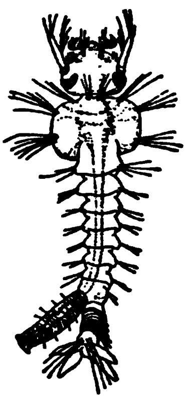
15. Life History. The life history or life story of an insect includes all the changes it undergoes from the egg to the adult (Section 13). The study of one insect as a type gives the class an idea of the life history of all insects belonging to that Order. The mosquito is a good type because all phases of its life history can easily be seen and because the insects can be obtained without difficulty.

16. Preparation. Dip a little water from the surface of the rain barrel or pool, running the dipper through the water much as you would a skimmer; pour the water into a glass fruit- or candy-jar; then dip some from the barrel so as to secure a number of wrigglers. Place covers of wire gauze or cheesecloth on the jars to prevent the escape of the mosquitoes.

17. Eggs. After a time examine the water carefully. You will doubtless find clusters of eggs floating on the surface. These come from the first water placed in the jar. These clusters are usually about a quarter of an inch in diameter and contain from two hundred to four hundred eggs, standing upon end and arranged in a single layer. The egg is shaped like a kernel of oats. With a good magnifying glass you will be able to see the structure of the cluster and the form of the single eggs. How long a time is required for the eggs to hatch?

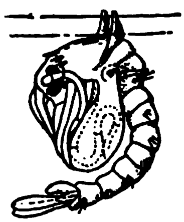


A CLUSTER OF EGGS



LARVA

18. The Larvae. Study the wrigglers. What is their shape? Place a few in a shallow white dish with just enough water for them to swim in, so that the pupils can get a good view of them. If you have several dishes for this purpose, it will facilitate the work. How long are the wrigglers? Why do they apparently hang head downward from the surface of the water? How long do they live as wrigglers? What do they eat?



PUPA

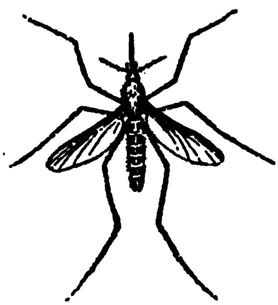
19. The Pupae. What objects besides wrigglers and eggs do you find in the water? Do these objects bear any resemblance to the wrigglers? What change do they undergo? How long a time is required for this change to occur? Notice that the wriggler rests in the water with the head downward, with the other end of the body at the

surface, while the pupa has the head upward, for the same reason—that it may breathe the taken-in air through the posterior extremity, and the pupa through the head.

20. The Perfect Insect. Notice when the mosquitoes first appear on the cover of the jar. Study the mosquito as a whole. How many wings does it have? How many legs? Are all the legs of the same length? Can you see the eyes? How many are there? The compound eyes are easily seen, and with a good glass a simple eye can be discovered. How does the mosquito bite? What does it feed upon? Examine the mouth organs with the magnifying glass. What is the shape of the proboscis?

How many kinds of mosquitoes appear? Are all equally annoying? The males are distinguished by carrying large, bushy feelers, those of the female being much more delicate. The distinction is easily made by the naked eye. The males are harmless, and it is only the females whose bite is annoying. Can the mosquito walk upon the water? Why do mosquitoes multiply so rapidly? Why do we have mosquitoes all summer? Why are they more numerous in some localities than in others? Have the pupils examine the region around the schoolhouse and the regions around their homes, in a search for breeding places.

21. Destruction of Mosquitoes. The lessons on the mosquito should be turned to practical account as fast as possible. Remove the wrigglers from the glass globe or the largest jar, and place them in another jar. Empty the first jar and place some pebbles and clean sand in the bottom; then add two or three plants taken from a pond or stagnant pool. Fill this jar with water to within two inches of the top. Place a goldfish in the jar containing the sand and pebbles. Collect a quantity of wrigglers from the other jar and pour them into the jar containing the fish. What



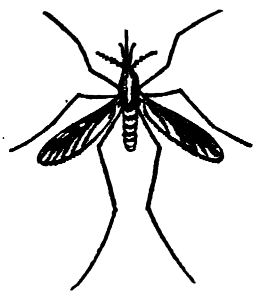
ADULT MOSQUITO

occurs? Perch and a few species of minnows will also eat the wrigglers, but only a very small number are destroyed in this way, so other measures must be adopted for their extermination.

Sprinkle a few drops of kerosene on the water in the other jar? What effect does it produce upon the wrigglers? If any mosquitoes are on the cover, dislodge them. What happens when they touch the water?

One ounce of kerosene to every fifteen square feet of surface is sufficient to exterminate all mosquitoes and wrigglers in any body of water. Lead the pupils to see how, by united effort, nearly every community can rid itself of these pests. Whenever possible, stagnant pools should be drained.

22. Mosquitoes and Disease. The species of mosquito most common in temperate regions is considered harmless. Another species, however, found in nearly all parts of the country, causes malaria by its bite. The malaria-bearing mosquitoes can easily be distinguished from the common species by noticing the following points: The wings of the common mosquito are clear, while those of the harmful species are spotted. The palpi of the common species are short, while those of the malarial mosquito are nearly as long as the proboscis. Any child old enough to study the mosquito can recognize these differences. In connection with this topic, ask the class to learn what they can about mosquitoes carrying yellow fever in Cuba and other tropical countries.



MALARIAL MOSQUITO

23. Applications. The life study of the mosquito prepares the class for a like study of other insects. The housefly should receive its share of attention. No attempt to breed flies should be made, but the children should be led to understand thoroughly that wherever filth is allowed to accumulate, breeding-places for flies are found, and that the best way to

prevent their multiplying in large numbers is to keep everything about the premises clean. The danger to health from flies is seldom realized. They sometimes convey typhoid fever, and they contaminate with filth everything which they touch. Impress upon the pupils the importance of keeping the home free from flies.

The honeybee, the wasp and numerous species of butterflies and moths afford interesting and profitable studies which can be pursued in accordance with the plans given above, making only such modifications as the life history of the insect requires. The relation of insects to agriculture is considered in the lesson on that subject, later in this volume.

24. Aids. The following works are helpful in preparing lessons on insects:

Nature Study and Life. Hodge. Pages 4 and 5. (Section 44.)
Farmers' Bulletin No. 155, United States Department of Agriculture: *How Insects Affect Health in Rural Districts.*
The Study of Nature. Schmucker. J. B. Lippincott Co.

STUDIES IN PHYSICS

INTRODUCTION

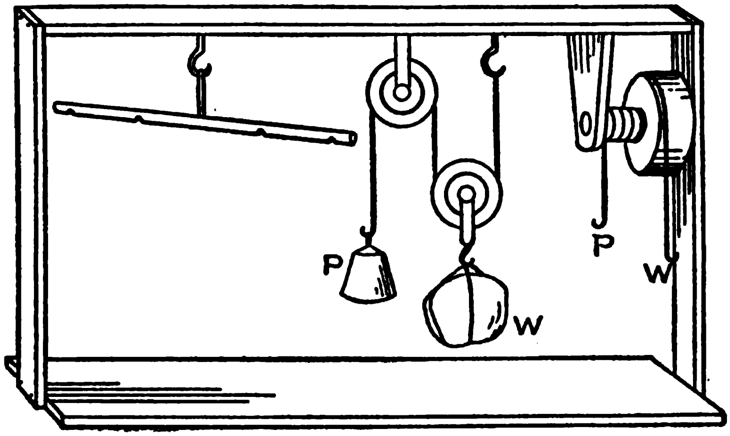
25. Explanatory. The exercises in physics are designed for pupils in the grammar grades, and those on the mechanical powers should not be attempted with classes that have not done at least a half-year's work in the seventh grade. The exercises include those subjects in physics which the pupils most need, and they are chosen with a view to their practical application to everyday affairs. The teacher should have at hand a good modern text-book in physics, and unless she is thoroughly familiar with the subject she should work out very carefully each exercise before presenting it to the class.

MECHANICAL POWERS

26. Machines. The older boys are always interested in machines. However, but few of them will understand what a machine is, or that the most complex machines are com-

posed of a few simple elements ingeniously joined together. These elements, to which the term *mechanical powers* is generally applied, are the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw.

Arouse an interest in these mechanical powers by such questions as these: Does a machine create power? Why



can a man do more work with a machine than with his hands? Does a machine do its work better than a skilled workman?

For convenience in illustrating the principles of mechanical powers, you need a frame like the one in the illustration. This is made by taking an inch board nine or ten inches wide and two feet long, nailing to each end upright pieces five inches wide and sixteen or eighteen inches long and then joining the tops with a piece of the same width.

The frame should be strongly nailed, since it will be subject to considerable handling and more or less strain. The illustration shows the lever, pulley, wheel and axle in place. The class should also be provided with screw-eyes of medium size, a number of wire hooks which can be screwed into a support, some six-penny wire nails, a few screws and some pieces of stovepipe wire.

27. The Lever. Have each pupil procure a piece of lath at least eighteen inches long. The lath should be planed

on all sides. With a pencil draw a line through the middle, from end to end. With a rule mark the lath off into sections six inches in length, then subdivide each of these sections so that the marks will be three inches apart. With a brad or a nail make holes through the lath on the middle line where each of the section lines crosses it. Place a nail through the hole in the center. Put screw eyes into the top of the frame, near enough to each other so that the lath can be supported by resting the nail upon them. If the lath does not balance, have the heavy end whittled carefully until the lath will remain in a horizontal position when on the support.

Have each pupil prepare two scale pans, using covers from tin boxes. The covers for each pair should be of equal size and as near the same weight as possible. Punch three holes in the rim of the covers so as to divide the circumference into three equal parts. Insert fine wire or linen twine in these holes; bring the three strands to a point and fasten them together. A hook made of stovepipe wire should be attached to the strings where they are tied together. Place nails in each of the holes in the lath. Hang the scale pans successively upon the nails, beginning with those at the end of the lath and working toward the center. See that the lath balances with the scale pans in each position. You now have a balance which can be used to illustrate the power and the principles of the lever. By using dry sand for a weight, a great many delicate tests can be made with this simple apparatus. Teach the parts of the lever—fulcrum and arms. Teach the names of the forces which operate upon the lever. The weight which is used to move the load is called the *power*. In the illustration, P means power; W, weight.

With the scale pans equally distant from the fulcrum, how much weight in one is required to balance the weight in the other? Hang one scale pan on the end of one arm and the other half-way between the fulcrum and the end of the other arm, and balance with sand. Place a given weight in the first scale pan. What weight is required in the second

to balance it?[1] Perform experiments by placing the power and weight at different distances between the fulcrum and the end of each lever arm and determine the exact weight required in each scale pan to balance the weight in the other. Notice the difference in distance through which the power and load move when the arms of the lever are raised or lowered. How do these distances compare with the weights in the two scale pans? Which weight moves over the greater distance? Measure the distance carefully and multiply each weight by the distance through which it moves. Compare the products. What do you discover? Have this exercise repeated a sufficient number of times to enable the pupils to understand thoroughly the principle of the lever. When this is understood, indicate it by the formula placed in the form of an equation:

Power multiplied by the power arm equals weight multiplied by the weight arm; or, *power multiplied by the space through which it moves equals the load multiplied by the space through which it moves.*

The next step consists in using and testing the different classes of levers. In how many ways do men use a crowbar? Illustrate by the lath or by a pencil or ruler. What is gained in using the crowbar in these ways? What is lost?

Place the power between the fulcrum and the weight. What is gained by this arrangement? What is lost?

Have the pupils discover and report the different classes of levers and their uses in tools and machines with which they are familiar; also have them discover the principle upon which the weighing scale is constructed. Why can you balance a load of coal or a load of hay with the weight of your hand on a platform scale?

Give problems such as these:

1. A man and a boy are carrying a weight of 100 pounds

[1] Weights for use in these exercises can be prepared by obtaining sheet lead from tea chests and weighing it out in half-ounce, ounce, two-ounce and four-ounce packages and rolling the lead together, or by taking bottles of different size and filling them with sand until the desired weight is obtained. This will probably have to be done at a store, for schools are not usually provided with weighing scales.

on a pole 12 feet long. Where must the weight be suspended that the boy may carry only one-third of the load?

2. A crowbar is 4½ feet long. The fulcrum is placed 6 inches from one end. What power will be required to lift a load of 1000 pounds? If the man's hand moves down one foot, how far will the load be raised?

3. Two boys have a plank 12 feet long, which they wish to use as a seesaw. One boy weighs 100 pounds and the other 75. At what point in the plank must the support rest in order that the boys may balance each other?

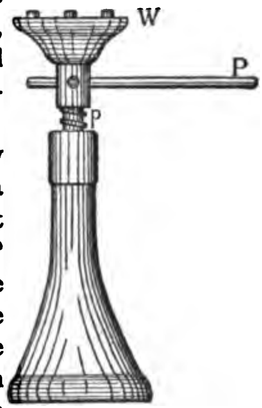
28. Wheel and Axle. Thrust a nail through the hole in the center of the lath and, using this for a pivot, with a piece of crayon resting against one end of the lath describe a circle on the blackboard. Without moving the lath from its position, describe another circle, holding the crayon six inches from the center. The large circle represents the circumference of a wheel and the small one the circumference of an axle. How do the distances from the center to each of the circumferences compare with the arms of the lever? If a load of 100 pounds is attached to the axle, what power will be required to balance it on the wheel? How can you solve this problem? What is the difference between the wheel and axle and the lever?

If any of the pupils have access to a turning lathe, it is well to have this piece of apparatus constructed. By making the wheel six inches in diameter and the axle two inches, you will have a machine with proportions which can be used without involving fractions. Mount the wheel and axle on the frame as illustrated in Section 26. When the power is attached to the wheel, what is gained? What is lost? When the power is attached to the axle what is gained? What is lost? What machines have you seen with the power attached to the axle? What is the reason for this arrangement? What machines have you seen with the power attached to the wheel? For what are these machines used?

29. Inclined Plane. Take a plank or joist, place one end on a wagon-box and let the other end rest on the ground.

Why is it easier to load a barrel of flour by rolling it up the plank than by lifting it into the wagon? If the plank is 12 feet long, the wagon 3 feet high, and the barrel weighs 200 pounds, what power will be necessary to roll the barrel into the wagon? An arrangement like this is called an inclined plane. See how many illustrations and uses of the inclined plane you can discover. Why do roads wind around hills? Why do railways in mountainous regions contain so many curves? The wedge is a form of inclined plane. For what is it used? How is the power usually applied?

30. The Screw. Cut from a sheet of white paper a right-angled triangle having a base eight or ten inches long and an altitude of two inches. Draw a heavy pencil line along the longest side of the triangle. Wind the triangle around a pencil, beginning with the wide end and keeping the lower edge of the paper even with the end of the pencil. What part of a screw does the black line represent? What, then, is a screw, mechanically considered? (A screw is an inclined plane wound around a cylinder; or, a rolled inclined plane.) If you can, secure the loan of a small jackscrew. If this cannot be obtained, a small vise will answer the purpose. With the screw in hand, teach the class the different parts—the thread; the body, which is the cylinder of the screw, and the pitch, or interval, which is the distance between the threads.



THE JACKSCREW

W, weight, or load; P, power; p, pitch.

Consider the cap of the jackscrew or the movable jaw of the vise as a load. How far does the load move at one revolution of the screw handle? The power is applied at the end of the lever. How far does the power move in one revolution of the screw? (The last question, of course, is based upon the supposition that the pupils are able to find the circumference of a circle when its diameter or radius is given.)

Can you see why with so small a power you can lift so large a load with a screw? Ask the pupils to observe the different uses to which the screw is put. After they have familiarized themselves with these uses, give occasional problems, such as the following:

1. If a screw has a pitch of $\frac{1}{8}$ inch and the power is applied to a handle 3 feet long, what load will a power of ten pounds lift? Through what distance will the power move in making one turn of the screw? How far will the load be raised?

2. A screw having a pitch of $\frac{1}{8}$ inch is worked by a lever that describes a circumference of 8 feet. How great a pressure will a power of 15 pounds produce? How far does the power move the load?

3. A jackscrew has a pitch of $\frac{1}{4}$ inch and a handle 15 inches long. What power will be required to lift a load of 100,000 pounds?

Which will lift the greater load with a given power, a screw with a large or small pitch? Why? Why is the screw particularly suited to the purposes to which it is applied?

31. Other Mechanical Powers. The foregoing exercises are typical of many that can be given on the mechanical powers. With these plans give lessons on the inclined plane, the wedge and the pulley. Before the exercises end, the pupils should be made familiar with all of the mechanical powers. In connection with each power given, use practical problems similar to those given above and lead the pupils to connect their arithmetic work with these and other lessons in physics. Problems relating to the exercises in physics can often form a part of the arithmetic lesson when the class is engaged upon that part of the subject to which such problems naturally relate.

GASES AND LIQUIDS

32. Elasticity of Air. If you can procure a quill, make a common popgun, or procure a toy airgun. Why is the cork or the pellet expelled with such force? Have you ever seen airguns used for shooting game or shooting at targets? Why are they effective?

Take a bicycle pump, hold the finger tightly over the end of the delivery tube and press down upon the piston handle. Why does the piston rise when the hand is removed?

These experiments and queries will call attention to the elasticity and expansibility of air; the pupils should look for other illustrations.

Why does the barrel of the bicycle pump become warm while pumping up a tire? (Compression of air raises the temperature.) Can you find other illustrations of this principle? If air is expanded, how will its temperature be affected? Feel the air as it is let out of an inflated bicycle tire. What do you notice with respect to its temperature?

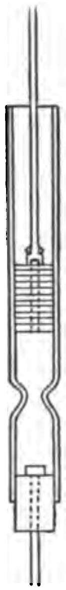
33. Pressure of Air. Fill a tumbler with water, place a card over the top, quickly invert the tumbler and remove the hand from the card. What keeps the water in the tumbler? Try the experiment with the tumbler only half full of water. What is the result? What would be the effect if a barrel full of water with a tight cover were inverted in a similar manner? Why?

Take a small tumbler or a small bottle having a large mouth, place in it a little cotton so pulled apart that the fiber will burn easily. Ignite the cotton and place the palm of the hand quickly over the mouth of the bottle. Why does the bottle adhere to the hand? How do you account for the drawing sensation produced by the bottle? Try the same experiment, inverting the bottle over a saucer of water. How much water is drawn up into the bottle? Why?

These experiments show that the air exerts pressure in all directions. The pupils should now learn that this pressure at sea level is equal to about fifteen pounds per square inch, and that it diminishes as the altitude increases. If they can ascertain these facts for themselves, have them do so; if not, state the facts to the class.

34. Pumps. A very effective lifting pump can be made after the following plan: Procure a lamp chimney, such as

is used on a student lamp, a spool that is of the right size to slide easily up and down in the tall part of the chimney, and a large cork that will fit tightly into the bottom part of the chimney. Soak the spool in water over night, then screw into one end of it two small screw eyes with long screws. Take a piece of pine about a half-inch square and fifteen to eighteen inches long; fashion it so that one end of it will just fit between the screw eyes. Place this in position and fasten it with two small screws, one through each screw eye. Just underneath this stick, and over the hole in the spool, tack a piece of thin leather or thin rubber about the shape and size of a dime. Use only one tack and drive this as near the edge of the leather as possible. Wind the spool with cotton twine or some other thread, so it will form an airtight piston to the chimney. Cut a hole through the center of the cork, and over this place a piece of leather like that placed over the hole in the spool. If you can procure a glass drinking-tube from a drug store and insert this in the cork, it adds interest. The cork should be made airtight. If necessary, cover it with wax or paraffin. Insert the tube in a vessel of water and work the piston. Watch the action of the valves. You will notice that they are very sensitive, and that as soon as the barrel of the pump is filled with water they yield to the slightest motion of the piston. Ask the pupils to compare this pump with those at home and see whether or not the two are constructed on the same principle. Will the lifting pump raise water to any desired height? Why?



LIFTING PUMP

A cubic foot of water weighs 62.4 pounds. What is the height of a column of water one inch square that will weigh 15 pounds? The solution of this problem will give the height to which water can be raised at sea level; but the pupils should be shown that this result is theoretical, and that because of imperfections in the pump,

especially leaky valves, the actual height is a little less than this.

Mercury is 13.6 times heavier than water. How high a column of mercury will the pressure of the air sustain at sea level? The solution of this problem naturally leads to the discussion of the barometer. If one can be obtained it is well to explain its facts and principles at this time, and have the pupils study it for a few days to notice the variation in the height of the column of mercury.

How can we raise water to any desired height with a pump? How does the fire engine throw such a powerful stream of water? From the study of the lifting pump, lead the pupils to construct a force pump, making only such changes in the apparatus as are necessary. An air chamber can be added to the force pump by taking a bottle with a large mouth and fitting it with a cork, through which two openings are made, one for the tube leading from the force pump and the other for the delivery tube leading to the vessel into which the water is discharged. Of what advantage is the air chamber? For what are force pumps used? To which class does the bicycle pump belong? Can compressed air be used for operating machinery? Why?

Call the attention of the pupils to the fact that air is typical of all gases, that all possess elasticity, that they can be compressed and that when external pressure is removed any gas will expand to fill the space within which it is confined. By cold and pressure many gases are changed to liquids. Can air be so changed?

35. Pressure of Liquids. The pupils have learned the weight of water. Procure a cylindrical pail or can and fill it with water. What does the pressure on the bottom equal? (The weight of the water.) How can we compute the pressure on the side? To answer this question the pupils must know how to find the convex surface of a cylinder; therefore, if a rectangular vessel can be obtained it simplifies the problem. Let the pupils discover the principle upon which this problem is solved, by such questions as these: What does the pressure

on the side where it unites with the bottom equal? What is the pressure at the surface? How can we find the average pressure for the side?

When the principles for finding pressure are understood, interesting problems involving their use can be added to the mensuration work in arithmetic; also lead the pupils to see the practical application of these principles by asking such questions as, Why are dams made so strong at the bottom? Why can water be used to operate machinery? Upon what does the power exerted by the water depend?

36. Buoyant Force of Liquids and Gases. Take one of the laths used in illustrating the lever, run a nail through the hole in the center and place it in the hooks on the frame. Attach scale pans to each end so as to form a balance. Suspend a small stone from one scale pan by a string at least four inches long. Place in this scale pan a small vessel that will hold a quantity of water, at least equal to the volume of the stone. Place weights in the other scale pan to balance; fill a vessel full of water and set this in a larger vessel; then move the apparatus so as to immerse the stone in the water. What happens to the opposite end of the scale beam? Leaving the stone immersed in the water, remove the larger vessel and pour the water which ran over into it in the small vessel in the scale pan. What effect does this have on the balance? How much do you think the stone loses in weight when immersed in water? Is it easier to lift a large stone under water than in the air? Why? From the experiment the pupils ought to be able to answer all these questions.

Why does wood float on water? Why does iron sink? Why will an iron kettle float? Will it float with a weight in it? Why will large iron ships float and carry heavy loads? How can you determine the load that a floating body will carry without sinking?

Procure a paper balloon. Inflate it out of doors with hot air. Why does it rise? If you wish to recover the balloon, hold it captive by a string attached to the frame. Why will a large balloon float and carry several people? How high

can a balloon rise? Why does it stop rising? These experiments and questions call the attention of the pupils to the buoyant force of liquids and gases and the practical uses which are made of this force.

37. Other Lessons. Use similar plans for lessons on sound, light, heat and electricity. Use a good text-book in physics as your guide. Construct simple apparatus and keep the work within the capacity of the pupils. With the employment of such means the pupils of the grammar grades should, before completing their work, have a fair knowledge of the elementary principles of physics.

STUDIES OF THE WEATHER

38. Importance. Changes in weather occur according to the operation of certain fixed laws which control atmospheric phenomena. Many of the underlying principles upon which these changes depend are easily understood, and a knowledge of them enables one to forecast the weather of one's locality for several hours with a good degree of accuracy. Ability to do this is of practical value, and an understanding of atmospheric phenomena and the principles upon which they depend dispels superstitions about the weather. Moreover, exercises of this nature are always interesting.

39. Winds. How is your schoolroom warmed? How is it ventilated? If a furnace or a jacketed stove is used, have the pupils test the direction of air currents in different parts of the room. For this purpose use strips of thin tissue paper about one foot long and two inches wide. Where are the upward currents? Why are they in that part of the room? Where are the downward currents? How do you account for them? Of what use is the chimney to a lamp? What is the direction of the air current in the chimney? Why?

If you build a fire out of doors, will it create currents in the atmosphere? Draw a diagram illustrating the directions which these currents will take. The answers to the above questions and solutions of the problems to which they give rise should make clear to the pupils the cause of currents in

the atmosphere. When these causes are understood the class is prepared to study the weather. Observations should be made systematically and carried through the term, a daily record being kept of the temperature, winds, condition of the sky, and the state of the weather. This can be recorded in two ways—by using tables prepared for the purpose and by constructing a weather chart upon which each of these facts will be graphically represented. These exercises will occupy but a few minutes each day, but they will need to be supplemented now and then by a special lesson.

WEATHER RECORD, JUNE

Day	Date	Temperature	Wind		Sky	Weather
Sat.	1	68	S. W.	Mod.	A. M. Clear P. M. Cloudy	A. M. Fair Even. Showers
Sun.	2	80	S. W.	Strong	Cloudy	Rain
Mon.	3	65	N. W.	Mod.	A. M. Cloudy P. M. Clear	Fair

Begin the work with the following questions: What is wind? How is wind caused? Why is wind much stronger at some times than at others? From what direction do the prevailing winds come?

Winds are horizontal movements of the atmosphere and are caused by the uneven temperature of different regions. Lead the pupils to apply the principles learned in connection with the study of warming and ventilating the schoolroom to the circulation of the atmosphere in general. Observe the order in which winds change. For the same locality this seldom varies, and over the greater part of the United States it is from southwest to west, northwest, northeast, east, south and southwest; that is, the great movements of the atmosphere are rotary, turning in the direction of the hands of a watch when the dial is in a horizontal position. What is the effect upon temperature caused by this variation of

the winds? Do the prevailing winds come from one direction in summer and from another in winter?

40. Humidity. Procure a shallow pan with square corners. An ordinary cake tin will answer the purpose. Pour in water to the depth of one inch. Set the pan in the schoolroom where it will not be specially affected by heat or winds. Have the pupils observe the gradual lowering of the water. How many days are required for it to lower one-half inch? At the same rate, how much water would have disappeared during this time from a surface as large as the schoolroom floor? From an acre? From a square mile? Problems of this kind can be used with seventh or eighth grades, or with the oldest pupils in some rural schools.

What hastens evaporation? What tends to prevent it? Do you think evaporation is equally rapid over all parts of the earth? Why? What is your idea of the quantity of water daily taken into the atmosphere by evaporation? From what source is most of this water taken?

Humidity is the term used to indicate the amount of water vapor in the atmosphere compared with the amount which it can contain. This amount depends upon temperature. The amount that would make cool air damp would not be noticeable in warm air. When the air contains all it can hold, it is said to be saturated.

41. The Dew-Point. Pour into a tin vessel some cold water. Wipe the outer surface of the vessel so that it is perfectly dry. How do you account for the moisture which soon gathers upon it? After the pupils understand the reason for the gathering of the moisture, perform another experiment. Partially fill the dish with water of the same temperature as the room. Stand the thermometer in the water, then sprinkle in slowly crushed ice or snow, watching carefully for the appearance of moisture on the outside of the dish. Note the temperature at which this begins to form. This indicates the temperature at which the atmosphere becomes saturated and begins to deposit its moisture. This temperature is known as the *dew-point*. How is dew formed?

Why is there more on some nights than on others? Why does it gather in larger quantities on some objects than on others? Of what use is dew to vegetation?

42. Clouds. When you breathe into a cold atmosphere what do you see? Ask the pupils to observe the steam issuing from the spout of the tea-kettle. Why is it invisible just at the mouth of the spout? What makes it visible a short distance from the spout? What is fog? What are clouds? Does fog ever change to clouds? Under what conditions do fogs and clouds form? What winds produce cloudy weather? Why? What winds produce clear skies? Why?

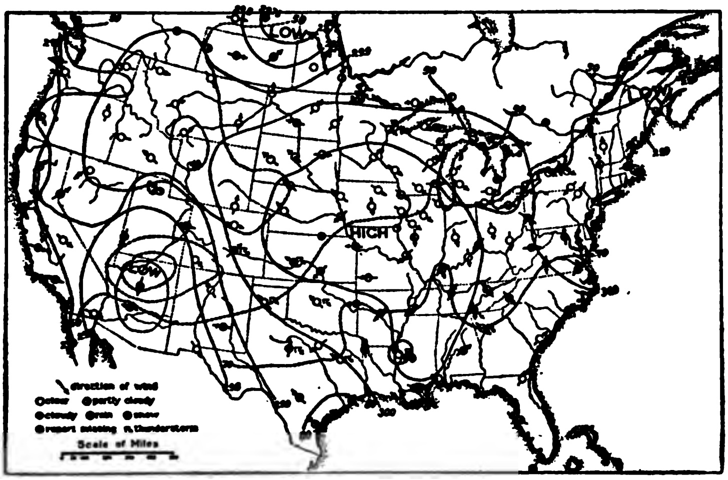
The answers to these questions will require observations extending over considerable time, and it is quite probable that you will need to assist the pupils by other questions or by explanations in finding the cause for fogs and clouds. In connection with these explanations, remember the influence of dust in the atmosphere upon the formation of clouds. Particles of dust attract water vapor and assist in its condensation; therefore, dust is an important agency in cloud formation.

43. Rainfall. When the temperature of the atmosphere falls below the point of saturation, a part of its moisture is precipitated as rain or snow. Have the pupils observe the conditions which cause storms, until they understand how rain is produced. You may not be able to explain satisfactorily peculiar local conditions, if they exist, but you should be able to explain how mountain ranges located like the Rocky Mountains affect the rainfall of the regions upon each side of them, how local showers are caused and why some winds bring rains and others fair weather.

44. Weather Bureau. Through the weather bureau the national government comes in contact with nearly all of the people, and it is of practical advantage to everyone to be able to read the weather maps and to understand the meaning of the signals displayed at weather observatories and in many other places. Before you can give lessons upon this subject

you will need to understand the barometer and be able to read the weather maps and signals yourself. If not familiar with these, consult a physical geography or an elementary meteorology. Study the weather map printed here and answer the following questions:

What do the heavy full lines represent? What do the numbers at the end of these lines indicate? What do the heavy dotted lines represent? What states are crossed by the isothermal 60°? In what places did thunder storms occur on that day? In what states did clear weather prevail? In what localities was the sky partially overcast with clouds?

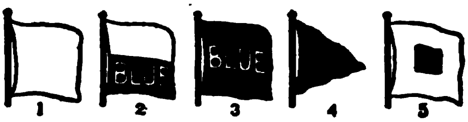


WEATHER MAP

Weather maps can be procured from the nearest weather observatory, and frequently from someone who receives them regularly from the bureau. They are usually displayed in postoffices and often in other public places. With the maps in the hands of the pupils, conduct exercises similar to those indicated above. An occasional exercise of this nature will enable the pupils to read these maps without difficulty.

Study the weather signals as given in the following figures. You can often interest the school in this work by having the

older pupils prepare a set of signal flags. The girls can make the flags, and the boys can procure and mount the flagstaff. Then run up the flags each day to represent the forecast obtained from the weather bureau. These forecasts are sent to all postoffices and it is seldom that a school is so situated that they cannot be obtained daily. For the making of desirable flags, the following material will be needed: Five yards of white muslin, five yards of blue and two yards of black calico. Obtain unprinted calico. This material will



WEATHER FLAGS

1—White: fair weather. 2—White and blue: local rain or snow. 3—Blue: general rain or snow. 4—Blue triangle: change of temperature; when above another flag, warmer; when below, colder. 5—White with black center: cold wave.

make a set of flags one yard square for the full flags and triangles one yard long for the half-flags. If flags a half-yard square are desired, only one-fourth this quantity of material will be needed. Drill the pupils on the use of the flags until they can give the meaning of each combination at sight. Have the pupils compare the forcasts with their daily record as explained on page 62, and determine what proportion of the forcasts are correct.

45. Aids. At the end of each division of the lesson on Elementary Science, books pertaining particularly to that division have been mentioned. Those given here are of a more general nature. It is assumed that every teacher has good text-books on physics, botany, zoology and physical geography.

Nature Study and Life. Hodge. 514 pages. Ginn & Co. This is the most helpful book on science lessons to be obtained. The text is clear and practical, and the illustrations are of great value.

The Study of Nature. Schmucker. J. B. Lippincott & Co. A plain, practical and helpful book. The work described is within the reach of all teachers and pupils.

Special Methods in Elementary Science. C. A. McMurry. 275 pages. Macmillan Company. This is a very helpful work in planning a series of lessons and preparing type studies. The bibliography is valuable.

Elementary Physics. Gifford. Teachers' edition. Thompson, Brown & Co. This little book contains many suggestions for experiments that can be performed with home-made apparatus.

WORK BY GRADES

46. Suggestion. The subjects treated in this lesson and the one preceding, together with the following outlines, indicate what may be done in each grade. These illustrative lessons and outlines are sufficient to give the teacher a working plan for any other branches of science which she wishes to introduce. The work in physiology is so closely associated with the work in school hygiene that it is explained in connection with that topic in Volume One, on *Hygiene.* In most schools, lessons on common minerals and on some chemical changes, such as combustion, fermentation and the action of acids upon alkalies, should be given.

Botany

47. Fourth Grade. The botany work in the fourth grade presupposes the mastery of the lessons in nature study in the previous grades. In the fourth grade attention should be given to the following:

(1) Study of small fruits, berry, squash, apple, plum.

(2) Planting and germination of seeds in window gardens or school garden.

(3) Raising flowers and vegetables.

(4) Study of simple spring flowers.

(5) Care of the garden through the summer. See the lesson which follows, Sections 3 to 6.

(6) Recognition of common trees by their bark, branches and leaves.

48. Fifth Grade. The work of the fifth grade covers some of the same ground as that in the fourth, but the study extends further and includes more complex subjects:

(1) Compound fruits; raspberry, blackberry, capsule.

(2) Collection of seeds for planting in the spring.

(3) Branching of trees.
(4) Study of the simplest fall wild flowers.
(5) Life history of a simple plant, as a violet or morning glory. See pages 6-18, *Study of Corn.*
(6) Raising flowers and vegetables in the garden.
(7) Study of buds and leaves.

49. Sixth Grade. Pupils of the sixth grade can study successfully the more minute parts of the plant:

(1) Dandelion, sunflower, asters.
(2) Methods of seed dispersal.
(3) Weeds. See pages 84-88, *Study of Weeds.*
(4) Coloring of autumn leaves.
(5) Recognition of woods by their structure and appearance.
(6) Work on the garden continued. Competitive raising of flowers and vegetables.
(7) Spring flowers not previously studied.
(8) Poisonous plants.

50. Seventh Grade. The botany work of this year should place emphasis upon the economic features of this subject and the protection of plants during the winter:

(1) Composite flowers, sunflower, goldenrod, asters.
(2) Special study of one tree as a type.
(3) Competitive gardening, raising flowers and vegetables.
(4) Life history of an economic plant, such as wheat, corn or cotton. See pages 6-18, *Study of Corn.*
(5) Flowerless plants, mushrooms, mosses, ferns. Pages 93-94, Section 27.

51. Eighth Grade. In the eighth grade the work of the previous grades should be summed up:

(1) Classification of fruits.
(2) Characteristics of the most common Orders of plants and the leading flowers belonging to each.
(3) Plant physiology.
(4) Competitive gardening. Page 78, Section 6.
(5) Preservation of forests.

52. Ninth Grade. The botany work of this grade will include the study of the subject from a text-book and the plan of the book should be followed.

Zoology

53. Fourth Grade. The work in zoology in the fourth grade is a part of the nature study lessons and is carried on entirely by observation:

(1) Study the dog.

(2) Ducks and geese.

(3) The care of poultry.

(4) Common insects, such as the fly, bee and wasp. See pages 40-50, Sections 3-24.

(5) Rats and mice, and the best means of exterminating them.

(6) Common songbirds. Pages 20-36, Sections 23-41.

54. Fifth Grade. The work of the fifth grade should enter somewhat more into detail than that of the fourth, and should include the study of animals and birds as types of the different Orders which they represent:

(1) Study the squirrel or rabbit as a type of the gnawing animals (rodents).

(2) The horse, the turtle, the muskrat and the salamander can be studied in a similar manner.

(3) Insects of the garden, giving special attention to those which are destructive, such as the cabbage worm and the currant worm. Pages 98-102, *Destructive Insects.*

(4) Clams, crawfishes, snails.

(5) Common birds, giving special attention to birds that feed upon destructive insects. Pages 20-36, *The Study of Birds,* Sections 23-42.

55. Sixth Grade. In this grade it is well to give some attention to zoology during the winter months:

(1) Study the feeding and care of livestock.

(2) Birds that spend the winter in your locality. Pages 20-36, *The Study of Birds.*

(3) The state laws for the protection of birds.

(4) Noxious insects, including those which are specially destructive to certain crops, such as the codling moth, chinchbug and Hessian fly. Pages 98-102, Sections 34-39.

(5) The earthworm, the mole, ants, spiders.

(6) Fishes common in the ponds and streams of your locality. In connection with this, call attention to the laws for protecting fish.

56. Seventh Grade. The work of the seventh grade should emphasize the economic feature of zoology, showing the

value derived from certain animals and birds and the injury caused by others:

(1) Life history of the toad. Same plan as adopted for study of the mosquito, Sections 15-20.

(2) Life history of the cat as a type of flesh-eating animals.

(3) Insects continued, taking up those that have not previously been considered, but are of such importance as to warrant devoting time to them.

(4) Continue the study of fishes. By use of reference works this can be continued to salt-water fishes; the important food fishes should be considered.

(5) Bird study continued, giving special attention to the English sparrow and other birds which destroy crops. Pages 20-36, *The Study of Birds*, Sections 23-42.

57. Eighth Grade. In the studies of the eighth grade all previous work should be summarized and unified:

(1) The study of the ox as a type of cud-chewing animals.

(2) The study of animals which destroy noxious insects and animals, as the bat, the porcupine and the weasel.

(3) Insect pests from an economic point of view. Pages 98, 99; 103, Sections 34, 35, 41.

(4) Game birds and bird laws. Also continue the study of song birds in accordance with the plan in pages 20-36, *The Study of Birds*.

(5) Frogs and salamanders.

(6) The chief characteristics of the leading Orders of animals, such as the rodents, the carnivorous animals and the hoofed animals, especially the ox tribe. The extent to which this work can be carried will depend upon the strength of the class and the time that can be devoted to it.

58. Ninth Grade. This grade should continue the work outlined for the eighth grade or pursue the subject by the use of an elementary text-book. In the latter case, the plan of the book should be followed.

Physics

59. Fourth Grade. The work in physics which can be attempted in the fourth grade will depend in a measure upon what has been discussed in the nature study lessons of the previous grade. The work should be very simple and should consist chiefly in calling attention to the principles involved

in numerous acts of everyday life. In the outline here given, the term *physics* is used in its broadest application, and some of the lessons suggested are closely related to chemistry:

(1) Water in its various forms and uses, as water, ice, snow, frost, vapor, steam.

(2) A few common tools, as the crowbar, the hammer and the hatchet or ax.

60. Fifth Grade. Continue the work of the fourth grade:

(1) The study of common implements about the home and school, as stove, lamp, furnace, egg-beater and meat-cutter.

(2) The study of ventilation; ventilation of sleeping rooms, the schoolroom, churches and public halls. Show the injurious effect of impure air.

(3) The formation of dew, fog and clouds.

61. Sixth Grade. Some of the lessons in this grade involve the principles of chemistry:

(1) Combustion, including the different kinds of fuel with which the pupils are acquainted.

(2) The action of soap and other similar preparations in cleansing. The ingredients in soap, and how it is made.

(3) Heat. How heat is produced; how it travels; conductors and non-conductors. The thermometer; construction and use.

62. Seventh Grade. The pupils in this grade should apply their knowledge of arithmetic to simple problems in physics:

(1) The mechanical powers (Sections 26-30).

(2) Pressure of the atmosphere; the siphon; the lifting pump (Section 33); the force pump.

(3) Sound; how it is produced; how it travels. Principles of the musical scale; musical instruments.

63. Eighth Grade. The work of the eighth grade can be somewhat more advanced but should be closely related to that of the seventh:

(1) Light. Sources of light; how it travels; reflection and mirrors; refraction; lenses; some optical instruments; camera; opera glass, microscope.

(2) Electricity; some of the ways electricity is produced; the electric current; conductors and non-conductors; electricity and magnetism; the dynamo, the electric motor, and some of the uses of electricity.

(3) Study of the atmosphere in its relation to the weather (Sections 38-43).

TEST QUESTIONS

1. Would the dragon fly answer the purpose as well as the grasshopper for studying the parts of an insect? If so, can you see any difficulty attending its use?

2. Besides a knowledge of insect life, what should the pupils gain through such studies as those of the grasshopper and the mosquito?

3. Name ten insects which pupils can study with profit after the plans given in their lesson.

4. To what Order does each of the following insects belong: katydid, potato bug, ladybird, cabbage butterfly, bumblebee, ant, the insect that produces the currant worm?

5. Present a plan for the study of the squirrel or some other animal common to your locality.

6. Why should pupils of grammar grades study the elementary principles of physics?

7. What is a machine? Can a machine create power? Why? Of what advantage are machines?

8. Describe the lever as illustrated in common shears, naming the parts and showing what constitute the power and the load respectively.

9. Why does warm air rise? Why does an upward current of warm air cause the formation of clouds?

10. Explain how you would use a weather map with a class of seventh or eighth grade pupils, and what would you teach from it.

LESSON FOURTEEN

ELEMENTARY AGRICULTURE

1. Value. Agriculture is the most widely extended and the most important industry of our country. The nation's prosperity depends upon that of the farmer, and whatever improves agriculture benefits all other industries. Recent years have been characterized by the application of scientific methods to all branches of industry. Processes of manufacture have been cheapened, new resources have been discovered, and national prosperity has been advanced.

If agriculture is to compete with our other great industries, it must rest upon an equally scientific foundation. The United States Department of Agriculture, the faculties of agricultural colleges and experiment stations, other leading educators, and influential farmers all recognize this fact, and within the last few years there has arisen an almost universal demand for teaching the elements of agriculture in the public schools. The branch is now required or strongly recommended in the course of study in nearly every state.

The introduction of agriculture gives definiteness to the work in nature study in the lower grades and furnishes a goal towards which many of the lessons in elementary science in the intermediate and grammar grades should trend. Agriculture is also closely related to geography and more or less closely associated with all other branches in the course of study. Moreover, lessons in agriculture furnish a new line of work for the older boys and girls of the rural districts and often induce them to remain in school for another term.

2. Plan. The exercises which follow are such as can be used in any school where material can be obtained, regardless of the locality. They are likewise typical of many other exercises that can be given by any teacher who is interested in the subject and is willing to inform herself upon it. The

lessons should be selected with reference to the season, so that as far as possible they may treat of the work which is being done on the farm. It is not necessary that the exercises be given in the order in which they occur in the lesson.

THE SCHOOL GARDEN

3. Utility. The school garden furnishes the best means for teaching and illustrating the principles of agriculture, and every school which does not already have one should try to secure a garden. The garden furnishes a center of interest and activity for all the pupils and also affords the best opportunities for connecting the work of the school with that of the home.

4. Arrangement. The arrangement of the school garden depends so much upon the size and shape of the grounds available that each teacher will have to make her own plans. The following suggestions are to serve merely as guides, and they do not apply to the schoolgrounds. That subject is treated in Volume One, page 29, Section 25.

(1) In laying out the garden, give due consideration to the schoolgrounds. The playground should not be sacrificed.

(2) A great deal can be accomplished on a small patch of ground, if it is properly utilized.

(3) If the schoolgrounds are small and additional space cannot be leased, make use of narrow strips along the fence and around the schoolhouse.

(4) If space will permit, have one or two experimental plots, which should be under your direction and for the use of the whole school.

(5) Reserve a plot which the younger pupils, including those of the first three grades, can use together.

(6) Apportion the remaining ground to the older pupils, so that each one will have a plot.

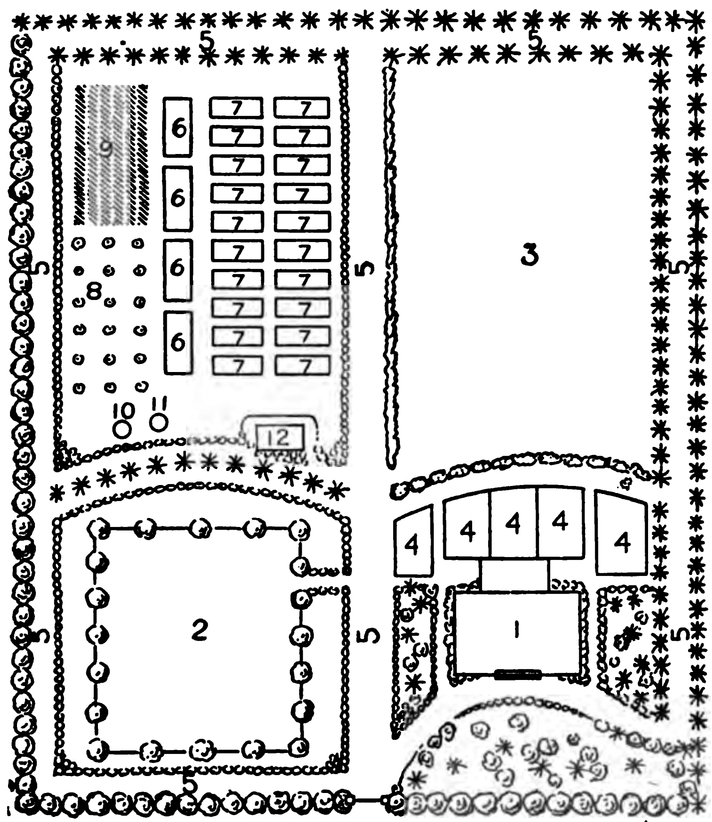
(7) Hold each pupil responsible for the planting and care of his plot through the season.

(8) Have everything done about the garden in a systematic and orderly manner. The plots should be well cared

for, the walks kept free from weeds, and all tools should be kept in their proper place when not in use.

(9) Make these plans with the pupils and have them agree to abide by whatever decisions are reached.

(10) Plant common things. The common flowers, garden vegetables and farm crops should receive attention rather than rare plants which may be regarded as curiosities.

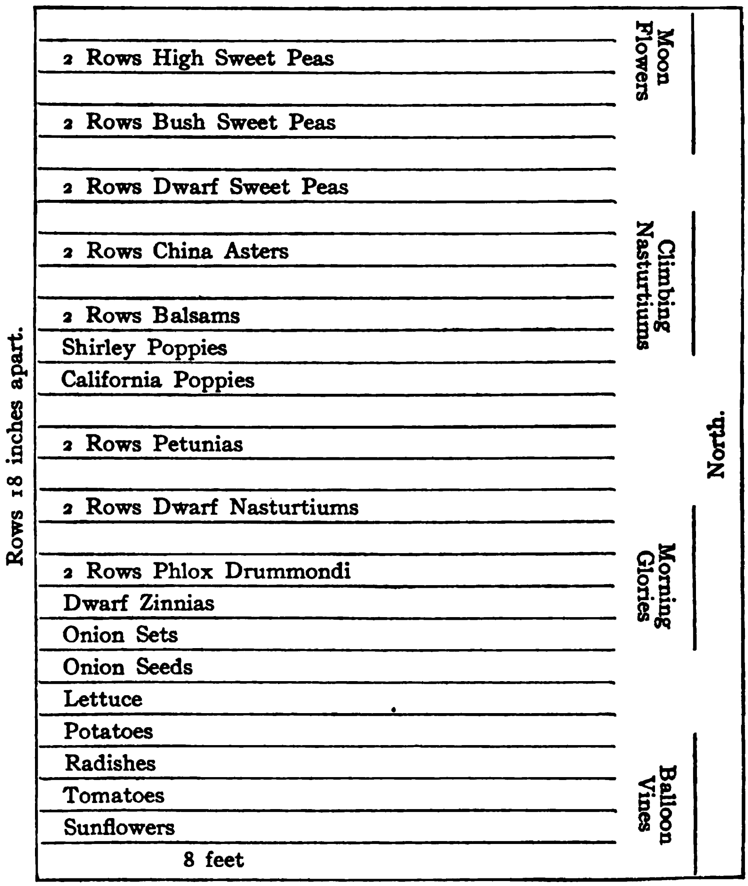


PLAN ONE

1, school; 2, girls' lawn; 3, boys' campus; 4, experimental plots; 5, avenues and walks; 6, experimental plots; 7, pupils' plots; 8, orchard; 9, forestry plot; 10, well; 11, tank; 12, garden shed.

While as far as possible each pupil should be allowed to decide for himself what he will plant in his plot, due regard should be given to variety.

(11) If you have a large garden, the rows should run east and west or north and south. The latter arrangement is better, because it admits the sun between the rows at all hours in the day. If, however, it is necessary to run the rows east and west, corn, pole beans and other plants which



PLAN TWO

have tall stems should be planted on the north side, so they will not cast a shadow upon smaller plants.

(12) The plan of the garden will depend to a great extent upon the size and shape of the schoolgrounds.

Plan One, page 75, is that of the Macdonald schoolgrounds, Bowesville, Ontario. It is ideal, but it requires large grounds.

Plan Two, page 76, is recommended by Prof. Blair, of the University of Illinois, for a garden 40 feet long and 10 feet wide.

5. Uses. The uses here emphasized are especially related to the work in elementary agriculture; but the teacher should not infer that they are the only purposes which the garden can serve. It should be regarded as the experimental farm of the school. On each individual plot the pupil is investigating on his own responsibility, and on the experimental plots ideas are worked out by the school as a community, under the guidance of the teacher.

(a) Germination. The garden enables the pupils to study the different plans of germination and growth represented by the various plants tilled in the garden and the field.

(b) Tillage. In the garden all the principles of tillage may be applied and their effects studied.

(c) Value of Fertilizers. By treating some experimental plots with one kind of fertilizer and others with another, comparative merits can be ascertained, and by leaving one plot without fertilizers their value can be shown.

(d) Weeds. If the pupils keep their plots free from weeds, they will realize how rapidly these plants grow and spread and the importance of finding the best means of prevention and destruction.

(e) Soil Water. What constitutes a proper amount of moisture in the soil is a problem requiring for its solution most careful observation, and in the school garden the effect of moisture can be studied daily.

(f) Soil. A knowledge of the structure and composition of soil is necessary to successful agriculture, and with the garden for an object lesson the class can be taught how to study soils.

(g) INSECTS. The insects which attack farm crops are sure to prey on the same plants in the school garden, and the pupils can here observe their habits of life and note the effect of various insecticides used in their destruction.

6. The Home Garden. Nearly all the exercises found in this lesson can be worked out by using the school garden, but the pupils should also make observations in the home garden and in the fields and compare results. If the school does not have a garden, each pupil should have a small plot of ground at home and do his work there. He should keep a record of his work and observations, and these records should form the basis of a school exercise once a week. Occasionally these exercises should be supplemented by excursions.

THE SOIL

7. Composition. Upon questioning the pupils you will probably learn that most, if not all of them, regard the soil as dirt. Ask several to bring flower pots filled with soil from their respective gardens. Protect a window sill from moisture on the sunny side of the room by placing a board upon it or by setting the pots in plates and placing them in the window. Dry a small quantity of soil from one of the pots and spread it very thinly on a sheet of white paper and examine it with the strongest magnifying glass you have. Are the particles all alike? How many different sorts can you find? How do you account for the difference?

Take a cupful of the soil, weigh it in the balance described on page 52, in Section 27. Dry it thoroughly and weigh it again. How do you account for the loss in weight? Now place this soil on an old shovel or a piece of sheet iron; put this in the fire and let it remain until the iron becomes red-hot. Does the soil burn? Allow the soil to cool; then weigh it again. Has it lost weight a second time? How has the soil changed in appearance as the result of heating? Why? How do you account for what you discover? The organic matter has been burned out, lightening the color, or the color may be redder.

Soil is composed of mineral matter, and decaying animal and vegetable matter known as *humus*. When heated to redness the humus will burn. Its destruction by fire of course removes some matter, so the soil on the third weighing should be lighter than on the second.

8. Life in the Soil. Have the pupils examine the soil in each pot for insects and other animals. How many different species are found? Keep the soil moist in one or two of the pots and leave it undisturbed. Have the pupils watch the plants that appear. How many different kinds are there? This question cannot be answered until the plants have grown a week or more. When was the seed from which these plants spring placed in the soil? How was it done?

9. Kinds of Soil. Have the pupils bring specimens of soil from different localities. Compare these as to color and material. Examine a portion of each specimen with the magnifying glass. In what respects do they differ? How deep was the soil where each specimen was found? This question can be answered by having each pupil make a V-shaped excavation having one side vertical and extending down into the earth as far as the layer of soil and then measuring the soil on the vertical side of the cut. The direction for doing this should be given at the time the pupils are asked to secure the soil; otherwise, an extra trip to the locality will be necessary.

The kind of soil is determined by its composition or structure. A sandy soil is one that is nearly three-fourths sand. A clayey soil contains over one-half clay. A limy soil is one that contains over one-fifth lime. A peaty or vegetable soil is composed almost entirely of decaying vegetable matter, or humus. A loam is a soil containing a mixture of sand, clay and humus. A perfect soil contains these various ingredients in perfect proportions. It has enough sand to enable it to absorb the necessary quantities of air and moisture, enough clay to prevent too rapid leaching or evaporation, sufficient loam to aid in the decay of

vegetable matter, and enough humus to enable it to retain the proper amount of moisture and to furnish the necessary material for maintaining the fertility.

A clayey soil is liable to be lumpy and hard, while a sandy soil is loose and friable. A heavy soil is one containing a large amount of water and not easily broken up. A light soil is one having a fine texture and is easily worked. Loams containing a sufficient quantity of humus are the most desirable soils.

10. Soil Water. Dip a marble in water and withdraw it. Is the water evenly distributed over its surface? How much water adheres to the marble? (Only enough to form a very thin film over the surface.)

If the marble were crushed to a fine powder, would more water adhere to the powder than to the marble in its present state? Take a quantity of fine sand as nearly equal in bulk to the marble as you can estimate. Dry thoroughly and place it in a small glass or cup. Add water drop by drop until all the grains of sand are covered with a film of moisture. How many drops were required? How many drops would be necessary to cover the marble? (Less than one.) How do you account for the difference? (The entire surface of all the grains of sand is much greater than the entire surface of the marble; consequently, it requires more water to cover all with a film of moisture.)

By these experiments lead the pupils to understand that the soil water used by plants is in the form of *film moisture*, that this water dissolves the plant food in the soil and enables the plants to absorb it through its roots. *Free water* is water in excess of film moisture, and when present it gathers in excavations when they are made. The height to which free water rises in the ground is called the *water table.*

Before the exercises on this topic are concluded the pupils should understand that the right amount of moisture is necessary to the most successful growth of plants. Too much moisture or free water drowns the roots, and when free water is present the land should be drained. When

there is too little moisture, the plant is not only deprived of the necessary amount of food which the water dissolves from the soil, but what is probably more important, it is deprived of a portion of the nourishment provided by the water itself. All plants contain more or less starch and sugar, and water enters largely into the composition of these substances.

11. Other Exercises. The foregoing exercises are typical of numerous others that can be given on soil. The following are important and should receive attention as time permits: tillage, fertilizers, and the formation of soils.

SELECTING SEED

12. Importance of Good Seed. Corn, wheat, oats, rye barley, rice, cotton and numerous other crops of less importance are all reproduced from seed. These crops constitute the bulk of our farm products, and the quantity of seed planted in the United States each year amounts to several million bushels. The selection of seed is a work of far-reaching influence, and every farmer should have all the information he can obtain on this subject. The principles and methods of selection can easily be taught to the oldest pupils, and the exercises are of interest because they introduce something entirely new.

13. Cereals. Because of their extent and value, the great grain crops demand first attention. Cereals "come true from the seed;" that is, the seed produces a plant like the one from which it came. If you plant a seed from a certain variety of wheat or corn, the same variety of wheat or corn will be produced. Not only does seed reproduce the variety; it also has a tendency to reproduce a plant with the same characteristics as the parent. Seeds from plants that are good bearers produce plants that bear well. Seeds from large, vigorous plants tend to produce large, vigorous plants, and so on.

In selecting his seed the farmer should be guided by certain principles, among which the following are important:

(1) Seed should be selected from the most perfect plants. The plant should be (a) strong and vigorous, (b) a good bearer, (c) able to resist drought, (d) able to resist plant diseases.

(2) Seed should be selected before the harvest. The farmer should go through his field and select the most perfect plants from which to take his seed, and should harvest these first.

(3) Repeated selection is necessary. If the farmer wishes to improve his crop he must select his seed year after year. For illustration: A farmer wishing to improve his wheat would on the first season go through the field and select enough of the best plants to give him sufficient seed to plant a small plot the following season. The seed from this plot should be used the second year for his crop, but before the wheat on the plot is harvested the most perfect plants should again be selected to furnish seed for a like plot the following season. By continuing this method from year to year, the variety of wheat will be decidedly improved, and it is in this way that many of the best varieties of wheat, corn and other grains are secured.

14. Characteristics of Good Seed. In order to select good seed one must know its characteristics, which are as follows:

(1) It is plump. With the exception of some varieties of peas, sweet corn and onions whose seeds are wrinkled, the seed should be well filled and smooth.

(2) It is of good color and luster. Good seed has a bright, clear color, appropriate to the sort to which it belongs, and it usually has a shiny appearance. If it lacks this appearance it was probably packed in bulk before being thoroughly dried and may have heated so as to kill the germ.

(3) It is new. Whenever possible, the seeds that have been raised the previous season should be selected, since the proportion of seeds which grow diminishes with age.

(4) It should be pure; that is, it should be free from dirt and from the seeds of other plants, especially weeds. The seeds of certain weeds resemble those of some cultivated

plants so closely that seed can frequently be adulterated without detection, unless the purchaser uses great care. When adulteration is suspected, a small quantity of the seed should be spread upon a white surface and examined with a magnifying glass.

As the different grains ripen, encourage the pupils to make selection of seed from the prevailing crops in your locality, and after the plan given in these exercises. Each pupil should keep his seed and plant it the next season. Then, in the following autumn, compare results which he obtained with those of similar crops raised from seed selected in the usual manner.

The wheat crop of the United States averages over 700,000,000 bushels. If by careful selection of seed this crop should be increased 25 per cent and wheat were worth 75 cents a bushel, how much would be added to the annual income of the farmers from this crop alone? Apply the same proposition to the corn crop, whose average is about 2,300,000,000 bushels. Does it pay to use time and care in the selection of seed?

15. Other Crops. Potatoes and many varieties of fruits are reproduced from cuttings. These plants will not reproduce exactly from the seed. The same principles should guide and the same care should be exercised in selecting the so-called seed, that is, the potatoes and cuttings which are to be planted for these crops, as are exercised in selecting seed for cereal crops.

16. Testing Seeds. Seed may have all of the external appearances of perfection and still be undesirable. One should know that it has strong vitality, that is, that nearly all of the seeds planted will grow. In localities having cold winters, the vitality of seed is often weakened by freezing. In such regions all seed designed for planting should be thoroughly dried before cold weather sets in and then kept in a dry place through the winter.

Teach the pupils how to test seeds for vitality. To do this, procure a number of plates or shallow tin dishes and

some sheets of blotting paper or pieces of flannel. Rectangular dishes are more convenient because they are readily divided into sections of equal size. Fit a piece of blotting paper or flannel to the bottom of each dish, then mark this off into possibly ten sections of equal size. If, to illustrate, you wish to test seed corn, take ten ears of corn, numbering them consecutively from 1 to 10. Number the sections in the pan in the same manner. Take ten seeds from each ear. Place these in the sections so that those from ear 1 will be in section 1, from ear 5 in section 5, and so on. Moisten the blotting paper or pieces of flannel and keep the seeds between them, covering the pan or plate with another dish so as to exclude the light. Keep the dishes in a temperature of from 70 to 75 degrees until the seeds sprout. Count the number of seeds that have sprouted. If nine seeds from ear 1 germinate and only five from ear 2, it is reasonable to suppose that nine-tenths of the kernels planted from the first ear will grow and only half of those from the second ear. These tests can be made in the winter or early spring, provided the schoolroom is warm over night. The tests should be made before the time for planting in the spring. Encourage the pupils to test seed which has been selected for the various crops of the farm and note results.

Some of the most valuable work which has been done by the experiment stations in different states has been in showing farmers how to test and to perfect their seed. The work of the Illinois and Iowa stations in perfecting seed corn is worthy of special mention, as it has resulted in increasing the income of the farmers of those states many millions of dollars.

WEEDS

17. What Weeds Are. The term *weed* is used somewhat loosely, but it generally means a plant which is unsightly or injurious to other plants among which it grows; so applied, grass or oats growing in a corn field would be weeds. However, our present application of the term is restricted to those

plants that serve no useful purpose and that propagate themselves with great rapidity. Weeds shade the crops, deprive useful plants of their nourishment and rob them of a large amount of their moisture. The loss to crops in the United States by weeds amounts to several million dollars each year.

18. Classes of Weeds. How many weeds can the class recognize and name? It is a good plan to make a study of the weeds most troublesome in the locality, according to the plan for the study of corn. (See pages 6–19, *The Study of Corn.*) This study will disclose the fact that some weeds live only one year (annuals), some live two years (biennials), and some live more than two years (perennials). Each class needs special treatment.

The weeds which are so troublesome as to receive special notice by the United States Department of Agriculture are the Russian thistle, prickly lettuce, bracted plaintain, horse nettle, buffalo bur, spiny amaranth, dagger cocklebur, chondrilla, wild carrot, wild oat, false flax and Canada thistle. Most of these are quite generally distributed over the country. However, you may have in your immediate vicinity others which, though confined to a smaller area, are equally troublesome.

19. Points to be Observed. In studying the life history of a weed, it is necessary to learn its habits of growth and propagation, the localities and crops which seem most favorable to it, and whether or not it has any insect or animal enemies. When these facts are determined, the most effective means for the prevention or destruction of the weed can be found.

Most weeds, and especially annuals, produce a large number of seeds, ranging from two thousand to eight thousand to the plant. The seeds are usually of strong vitality, and the plant has some means by which they may be widely scattered. The agencies through which these seeds are dispersed are the plant itself, the wind, birds and other animals. The seed vessels of some of these plants burst with considerable force, scattering the seed for several feet in all directions, but many annuals have stems with numerous

branches, and when uprooted in the fall they are so nearly round that the wind blows them about readily and they scatter seeds wherever they go. Weeds taking this form are generally known as tumbleweeds, and the name is applied to several different species. Ask the pupils to find what plants produce seeds with burs or hooks so they can attach themselves to animals. Doubtless they are all familiar with tickseed and burdock, but they may never have thought of the purpose served by the seeds in sticking on to whatever comes in contact with them. Ask the class to find tumbleweeds, also to notice how the seeds of the thistle, milkweed and the prickly lettuce are scattered.

PRICKLY LETTUCE

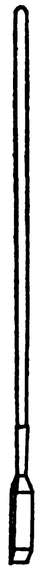
Why do weeds grow so profusely along fences and by the sides of roads? The answer to this question will lead pupils to see that birds perching on the fences frequently drop seeds which take root and grow.

Another way in which weeds are scattered is by their seeds being mixed with the seed planted for the crop. In this way the Russian thistle and others of the most injurious weeds in the country were introduced from Europe. The seeds of some of these weeds resemble the true seed so closely, as in case of clover and grass, that one must be an expert to determine whether or not such seed is adulterated. If in doubt, a small quantity of the seed should be spread upon a white surface and examined with a magnifying glass. This will bring out the difference in form and color, and whenever seed is suspected of adulteration, a very careful test should be made before planting.

Have the pupils gather the seeds of these different weeds as they mature and study them until they are able to recognize them wherever met.

The root of the weed should also be studied. Is it fibrous or fleshy? Can you tell from the root whether the plant will live one year, or longer?

20. Destruction of Weeds. The habits of the plant being known, the pupils should have their attention called to the most effective methods of their extermination and prevention. Since annuals die down to the ground at the end of the season, they can be exterminated by preventing them from seeding. Cultivation early in the season is, therefore, much more effective than at any other time. It must be remembered, however, that not all of the seeds of an annual germinate the first year. Some may remain in the ground for two or even three years, and however carefully the plot infested with such weeds may be tilled the first season, the farmer may expect a crop of the same weeds the second season, although it will not be so large, and possibly a few others will be found the third season; but by persistent cultivation from year to year, the weeds will be destroyed.


A SPUD USED FOR CUTTING WEEDS

The first year biennials store their nourishment in the root, which enables the plant to develop very rapidly and produce a large number of seeds the second year. These plants can be killed by cutting off the root a few inches below the surface of the ground. This same method also applies to many perennials, though these weeds are more difficult to kill than those of either of the other classes. A spud, which is a chisel attached to a fork handle, is the most effective implement for this purpose. Where a plot is badly infested with perennial weeds like the Canada thistle, it is a good plan to plow the land, then rake together as many of the roots as possible, and when they are dry, burn them. This will not eradicate all of the weeds, but it will destroy a large number; and by following the plan at each plowing, in the course of two or three seasons the most of these weeds will be destroyed.

The sources from which most weeds spring are untilled land, such as old pastures and the narrow strips along fences and roadsides in which the weeds mature and scatter their seed. However carefully one farmer may till his land and eradicate weeds from such places, he can never wholly free his land unless his neighbors are equally particular, for the seeds from most of these pernicious plants travel long distances. This point should be fully impressed upon the class in connection with this study. United action is essential to ridding any locality of noxious plants, destructive insects and plant diseases.

CANADA THISTLE

Send for Farmers' Bulletin No. 28, United States Department of Agriculture, entitled *Weeds and How to Kill Them.*

ROTATION OF CROPS

21. Plant Foods. The most important plant foods furnished by the soil are nitrogen, potash and phosphoric acid. When any one of these foods is exhausted, good crops cannot be obtained. Plant food can be restored to the soil by tillage, by fertilizers and by growing certain crops which are plowed under. The most favorable crops for this purpose are cow-

peas and the various clovers, because they all extract nitrogen from the air and store it in their roots. When the roots decay the nitrogen is given to the soil and can be used by other plants as food.

22. Observations. What are the prevailing crops in your locality? Do the farmers generally raise a crop of the same kind on the same land year after year? If so, how does the yield of each succeeding crop compare with that of the previous season? How does the present yield compare with the yields eight or ten years ago? (Have pupils ascertain this fact from farmers who have resided in the neighborhood for a long time.)

Do any farmers raise different crops from the same piece of land in successive seasons? If so, how does the yield of their crops compare with the yield of the same kind of crop on farms where this practice is not observed? If there is any marked difference, ask the pupils how they can account for it.

How does the change of crops affect the growth of weeds? Why are the crops in those fields where they are not frequently changed more liable than the others to be attacked by smut, rust or other diseases? Are they more frequently attacked by destructive insects? The answers to these questions will require examination of the fields at frequent intervals through the season. If rotation of crops is not generally practiced, but is practiced by a few farmers, the contrast will probably be quite noticeable; other conditions being equal, the results will be in favor of the farmer who practices rotation.

23. Reasons for Rotation. Rotation of crops is beneficial to the soil and profitable to the farmer for the following reasons:

(a) IT PREVENTS EXHAUSTING THE SOIL. No two plants extract in the same proportions the same kind of food from the soil. For illustration, corn requires nearly three times as much nitrogen as oats and twice as much as wheat, while hay requires more nitrogen than oats but only about

one-half as much phosphoric acid. By change of crops the different foods are used in such a way as to prevent any one from being exhausted. Again, some crops have shallow roots and feed from the layer of soil near the surface. This is true of most annuals. Others, especially the root crops, are deep feeders and extract a large part of their nourishment from the deeper layers of soil. Thus, by alternating shallow with deep-feeding crops, the plant food from all of the soil is more evenly utilized.

(b) Suppression of Weeds. Some weeds seem to have a peculiar affinity for certain crops and are found mixed with them or bordering the field. If this crop is planted on the same ground for several seasons in succession, the weeds gain such a hold that it is very difficult to eradicate them. Again, some crops, like wheat and oats, prevent tillage. If these are followed frequently by such crops as corn or potatoes, which admit of tillage through the season, most of the weeds are destroyed.

(c) The Prevention of Insect Pests. Every plant has its own insect enemies, such as the wheat weevil and the chinch bug, the former feeding upon the wheat and the latter upon both wheat and corn. If the crops are continued from year to year, the ground becomes infested with the eggs and cocoons of these insects to such an extent that they become very destructive; but if the crops are changed each season most of the insects perish because their food is taken away.

(d) Prevention of Plant Diseases. What we have said about insects is equally true of such diseases as rust and smut on corn and blight and rot on potatoes. While some of these diseases may appear on plants which are nearly related, most of them are confined to the particular plant on which they are found, and by changing crops each season they are unable to obtain a hold which enables them to do any great damage.

(e) Certainty of Income. A rotation and variety of crops usually assure the farmer of an income each season.

If one crop fails, another usually succeeds. While doubtless he might be more prosperous some years were his land all given to one product, yet in a succession of years he receives a greater income by having a variety of crops.

24. Course of Rotation. What is known as the *course of rotation* is the order in which the crops regularly succeed each other. Local conditions are so varied that a course which would be suited to one locality might not be adapted to another; therefore, no specific directions for a course of rotation are attempted. The arrangement shown in the table, which is taken from *Agriculture for Beginners*, shows the principles by which the farmer should be guided:

First Year		Second Year		Third Year	
Summer	Winter	Summer	Winter	Summer	Winter
Corn	Crimson clover	Cotton	Wheat	Cowpeas	Rye for pasture

It will be noticed that two crops are provided, cowpeas and crimson clover, which have for their purpose the improvement of the soil by restoring nitrogen and at the same time providing a crop of hay; two crops for money—wheat and cotton; two cultivated crops which admit of tillage to kill weeds and for physical improvement of the soil, and two crops suited to livestock—corn and rye for pasture. This arrangement shows the objects to be attained through a course of rotation, and while the crops here given would not be suitable to all localities, other crops can be substituted in such a way as to preserve the plan and enable the farmer to attain the purposes indicated.

The rotation most generally practiced in the corn-growing states is grass and clover three years; corn two years; wheat or oats one year. What is known as the Norfolk System, from Norfolk County, England, is also in use in those states not admitting of a winter crop. The original system produces

four crops, each for one year, as follows: turnips, barley, clover, wheat. Where used in the United States, this system is modified to meet local conditions.

DISEASES OF PLANTS

25. Injurious Effects. Nearly all plants raised upon the farm are subject to disease. The diseases are caused by minute plants (fungi or bacteria) which live upon or within the plants that they injure or destroy. These plants are so small that single specimens cannot be seen without a magnifying glass, and some of them only by the aid of a compound microscope. The damage done to cereal crops alone in the United States by plant diseases is estimated at $200,000,000 annually. In addition to this, nearly half of the apple crop is lost each year by rot, and in some localities the entire peach and plum crop is destroyed in a similar manner. Much of this loss could be prevented if the farmers knew what to do.

26. What to Teach. The prevention and destruction of fungi causing plant diseases depend upon a knowledge of the manner of growth, length of life and changes in form of the fungus causing the respective diseases with which the plants are affected. The lessons on plant diseases should acquaint the pupils with these facts. As far as possible the facts should be learned by direct observation; but those which can be ascertained only through the work of specialists should be given the pupils as they are needed.

The diseases which should receive attention first are those that are causing the greatest damage in your locality. The time at which the lessons are given should depend upon local conditions. The effect of the disease is best seen at that season of the year when the crops reach maturity, but its progress can be studied to the best advantage during the weeks preceding this, and the means of prevention should be considered in the spring before the planting begins. A few diseases, like fire blight and black knot, can be studied in the winter. The lessons should be given when they will be most effective. You should become acquainted with the

subject which you wish to teach, both by observation and study. In addition to the information which you can gain from original sources, you should add all that can be acquired from reading the works of good authorities. Be enthusiastic; awaken an interest in the pupils and lead them to become enthusiasts in this work, and their influence will have a very beneficial effect upon the community in which your school is located.

27. Preliminary. The pupils are probably familiar with mushrooms and puffballs. Have each pupil bring to the class a ripe specimen of mushroom and puffball, if these can be obtained. The large mushrooms with gills are the best for this exercise. After picking, they should be kept with the top down.

Have each pupil lay a piece of paper on the desk. If the mushroom is white, use colored paper; if dark, use white paper. Break the stem from the mushroom close to the gills, then lay the top on the paper, gills down; cover with a glass and leave in this position for a half-hour or more. When you return to the exercise, ask the pupils to remove the glass and the mushroom from the paper very carefully, raising each directly up and taking care not to create the least current of air. What does each pupil find upon his paper? (If the experiment has been successful an imprint of the under side of the mushroom will have been formed on the paper by the spores which have fallen from between the gills.)

Ask one of the pupils who has a ripe puffball to squeeze it. What forms the cloud of dust? Catch some of the dust on white paper. Can you see the separate grains? What about their size?

From these exercises the pupils should gain some knowledge of the large number of spores produced by plants of this sort, of the minute size of these spores and the ease with which they can be scattered. This will lead them to see why plant diseases can spread so rapidly.

While it is not necessary to describe the minute structure of a spore, you should lead the pupils to understand that

in plants of this class it takes the place of the seeds in the more perfect plants they have been accustomed to study.

Caution. Some mushrooms are deadly poisons, and pupils should be told emphatically that they must not eat them.

When these facts are understood, the class can study the plant diseases which are considered most important. The topics outlined for study in this division of the lesson are selected because these diseases are generally prevalent, but there are many not named, and some of these may be of equal or greater importance in your immediate locality; hence, you should be guided in your choice of topics by local conditions.

28. Rusts. Rusts appear on wheat and other small grains and grasses. They are so called because of the peculiar color of the spores which they produce. The disease is caused by a minute fungus. It usually begins with little black dots and lines that appear on the surface of the stem late in the summer. These lines are made of innumerable spores which constitute the form in which the fungus survives the winter. In spring each spore begins to grow. However, it dies in a short time unless it is carried to a barberry bush. Upon the leaves of this shrub the spores continue to grow rapidly and soon form little chains of fringed cups on the lower side of the leaves. These cups produce a different variety of spore, which is carried by the wind or other means to wheat, grass or other crops where these spores force their way into the pores of the leaves and mature the fungus that spoils the crop. The fungus has three distinct stages in its life circle, and a complete knowledge of it requires observation extending from one season over to the next. The spores in the spring usually start from self-sown grain; therefore, all such grain should be plowed under early. They also adhere to the straw and are liable to be carried to the field the next season and infest a second crop, if such straw is used for fodder or bedding. Fields affected with smut should have the stubble burned after harvest, and it is usually wise to burn the straw. The margin of the field should be kept free

from barberry bushes and other plants on which these spores may lodge. These measures and a frequent change of crops will usually prevent the spread of rust.

Have the pupils examine neighboring fields for the appearance of rust. If it is found, ask them to measure a square foot of the field in some part where the disease appears, count the number of plants within the space measured and also the number affected with rust. From these a very fair estimate of the portion of the field affected can be obtained.

29. Smut. Smut attacks wheat, oats, barley, and especially Indian corn. It is developed and propagated by the means of spores, in much the same manner as rusts. However, the spore of the smut fungus works differently from that of the rust fungus. Some spores are capable of attacking the plant only when it is young. The spore penetrates to the interior and grows toward the end of the stalk, dividing wherever the stalk divides and sending a minute filament into each branch until finally it works to the tips of the shoots which bear the fruit. For this reason the presence of smut cannot be detected until the fungus is fully developed. This is best illustrated in corn. With this plant the smut does not appear to cause any damage until the kernels are well formed. Then in the course of a few days those at the end of the ear swell, burst and throw out a large quantity of black powder which consists of the perfected spores. These can be carried long distances by the wind. They lodge in the soil, fall upon manure heaps or find homes in other suitable places, where they develop a second kind of spore which is carried to the corn plant the next season and begins its career on the new crop.

Because of the large number of spores and the way in which the fungus works, smut is very difficult to eradicate. Whenever possible, the ears affected by it should be destroyed and seed from an affected field should not be planted. When smut attacks oats or barley, it may not be discovered until thrashing time; then the escaping spores form clouds of black dust. Spores can be destroyed on the seed by soaking

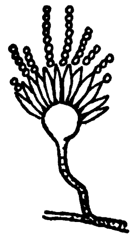
the seed from ten to fifteen minutes in water raised to a temperature of 132 to 135 degrees Fahrenheit. The heat should not exceed the latter temperature and the seed should be thoroughly stirred so that the water may be brought in contact with the entire surface of every kernel. This treatment does not injure the vitality of the seed and it often saves the farmer a crop. When a field is badly affected with smut it should be planted to some crop upon which this fungus cannot work. One or two seasons of this treatment will eradicate the disease.

30. Potato Blight. There are two forms of potato blight, known as the early and the late blight. The pupils should be asked to look for the appearance of this disease, and if found it should be studied. The early blight is due to the growth in the tissues of the leaves of a fungus which causes the leaves to turn yellow and dry up. This blight does not usually affect the tubers. However, if it begins early in the season, it decreases the yield. The later blight is likely to attack the crop during warm, damp weather. It sends its filaments down the stalk into the tubers and causes them to rot. Farmers not understanding the nature of this disease think that the rot is due to some condition of the soil. Both of these diseases can be prevented by spraying the vines with Bordeaux mixture (See Section 45). Usually three applications in a season will preserve the plants in good condition. Sometimes the spores from this blight do not develop until the tubers have been stored for the winter, and the farmer is much surprised to find that his potatoes are rapidly decaying.

WHITE MOLD

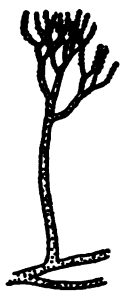
31. Scab. Another disease which is likely to affect potatoes is scab. Doubtless pupils can bring potatoes that have been attacked in this way. Examine the scabs with the magnifying glass. Each scab is a plant and grows from a

spore. The spores may exist in the soil before the potatoes are planted. This will be true if the ground produced a scabby crop of potatoes the previous season. If affected potatoes are planted, an affected crop may be expected; therefore, only healthy potatoes should be used for seed. The scab can be prevented by dipping the potatoes, before planting, in a solution made by adding a pint of formalin (a liquid that can be obtained of any druggist) to fifteen gallons of water, and allowing them to remain in the solution from one and one-half to two hours. Formalin is not poisonous, but potatoes thus treated should not be eaten nor fed to stock. Study the apple scab in the same manner. Doubtless in the fall numerous apples having black scabs on the surface can be obtained. These are caused by another sort of fungus which works upon the apple in a similar manner.



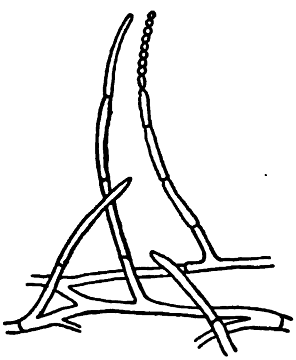
BLACK MOLD

32. Molds or Mildews. Place a piece of bread in a damp, warm place where it is excluded from the light and allow it to remain for several days. Have the pupils, with a magnifying glass, examine the mold formed. With a glass of good power some very interesting forms will be discovered. There are many species of mold or mildew, and they attack numerous plants, especially the rose, grape, plum and peach, and often cause serious damage. The most common forms are shown in the illustrations printed on pages 96, 97 and 98. They are highly magnified. Mildew on grapes can easily be detected by examining the under side of the leaves, where it appears in the form of pale spots or scales, which are covered with silky, thread-like organs. The mold on fruit usually appears as a whitish bloom or roughish brown coating. The latter is known as brown rot, and it is very destructive to plums and peaches. The fruit so affected



BLUE MOLD

often remains on the tree and dries, forming what are known as *mummies*. These dried fruits are full of spores, and unless they are destroyed will constitute a source from which the disease will be propagated to the next crop. The brown rot and most other mildews can be prevented by spraying either with a simple solution of copper sulphate in a proportion of one pound of sulphate to eighteen or twenty-five gallons of water, or by a weak solution of Bordeaux mixture. Two or three sprayings during the season will be necessary to preserve the fruit, and the result depends almost entirely upon the thoroughness with which the work is done. Every branch and leaf of the tree should be touched by the spray.



MILK MOLD

If fruit is grown in the locality in which your school is located, lead the pupils to watch for the appearance of these molds and then secure their interest in spraying trees.

33. Other Diseases. The plans given show what can be done with other plant diseases. If you live in one of the cotton states, you will need to give attention to the numerous diseases which attack the cotton plant. If in a tobacco region, other diseases are important. Send to the experiment station of your state for information on diseases prevalent in that locality, and you will secure much valuable assistance. Send to the Department of Agriculture, Washington, D. C., for Farmers' Bulletin No. 75, on *Grain Smuts and How to Prevent Them*, also for Bulletin No. 20 of the Bureau of Vegetable Physiology and Pathology. Each of these works will furnish valuable information.

DESTRUCTIVE INSECTS

34. Classes. For the purpose of destroying them, insect pests are considered under two classes, biting insects and

sucking insects. This distinction is important, because insecticides that are effective with the first class are harmless to the second. Biting insects feed upon foliage, and any preparation which poisons the leaves of the plant destroys the pest. Sucking insects feed upon the juices of plants and extract them by boring through the outer tissue or bark; therefore, poisoning the foliage has no effect upon them. A preparation which poisons the insect by contact must be employed. Spraying mixtures containing Paris green or London purple will usually destroy biting insects, and a preparation of kerosene known as kerosene emulsion, or a solution of tobacco soap, will destroy most sucking insects. Where plants can be enclosed, lice can usually be destroyed by fumigating the plants with tobacco or with carbon disulphide. In all cases spraying or fumigating is most effective if applied early, as soon as the insects are discovered. See Section 45 for spraying preparations.

35. Directions. Lead the pupils to understand the facts here given and to apply them in connection with the study of insect pests. For the life study of these insects, follow the plans given on pages 39–50, Sections 2 to 24, inclusive. In studying insect pests, it is necessary for the pupils to learn:

(1) To recognize the insect in each stage of its growth—the egg, the larva, the pupa and the imago.
(2) How long the insect lives in each stage.
(3) Upon what the larvae feed.
(4) The time and place of laying the eggs.
(5) How the insects pass the winter.
(6) How the ravages can be prevented.

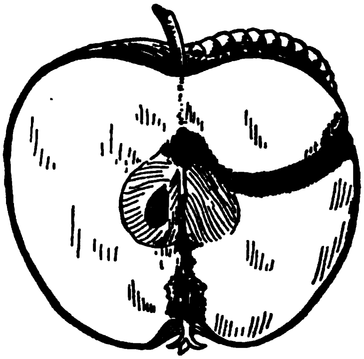
To ascertain these facts it will usually be necessary for the class to continue observations through a year.

36. Cabbage Worm. What sort of butterfly is seen around the cabbages about the time the young plants begin to head? Have the pupils catch some of these in the insect net and place them in their cages. Place fresh cabbage leaves in the cage each day. Do the butterflies lay eggs

on the leaves? Put some worms in the cage and feed them till they change to the chrysalis stage. From what is the chrysalis suspended? How long does it take it to hatch? (In the North there are usually three broods in a season; in the South the number of broods is greater.)

The cocoons of this butterfly are often found in the fall, suspended from the under side of fence boards, railings and other similar shelters. By placing boards on the ground in a cabbage patch in such position that the worms can crawl under them, many cocoons will be fastened to the boards and these can be collected and destroyed. This is one of the most effective means of keeping this pest in check. Since poisons cannot be used after the plants begin to head, they have but little effect.

37. Codling Moth. How many of the class ever found a worm in an apple? How did it get there? What is it there for? Lead the pupils to examine the apples on a tree early in the season, very soon after the blossoms fall. Are any milk-white spots found on the growing fruit? If so, examine some of them with your strongest magnifying glass. Can you tell what they are?



CODLING MOTH

Have each pupil select a few affected apples on a tree at his home and watch these spots from day to day. What change finally takes place in these spots? What becomes of the worm? When does the worm leave the apple? Where does it spin its cocoon? Later in the season, in early autumn or in midsummer, pupils should look for these cocoons under the scales of the bark on the trunk of the tree. Doubtless a number will be found upon each tree. If these scales, which form the rough bark, are scraped off, many cocoons are destroyed and one of the

favorite places for spinning the cocoons is removed. This can be done without injury to the tree. Have the pupils collect a few cocoons and keep them in a safe place until they hatch in the spring. In this way they will be able to recognize the moth, which is seldom seen. Do not let the moths escape.

It is estimated that the damage done by the codling moth in the states of Nebraska, Illinois and New York exceeds $7,000,000 each season; therefore, any preventive measures which will stay its ravages should be understood and employed. The following are among the most effective:

(1) Since decaying fruit trees form the best places for hatching the cocoons, all such trees, as well as all brush in and about the orchard, should be destroyed.

(2) The trees should be sprayed with Bordeaux mixture just as the blossoms fall, and again in about a week or ten days.

(3) Trunks of trees should be kept smooth, so that the worms cannot find lodgment for the cocoons.

(4) Many cocoons can be collected by banding the trees with strawboard, cotton flannel or any other fabric that will form a shelter to the worms.

(5) Wormy apples usually fall to the ground before the perfect fruit is ripe. These should be gathered as soon as they fall and so disposed of as to kill the worms before they emerge to spin cocoons. They may be used for making cider or feeding pigs.

38. The San Jose Scale. The San Jose scale is a minute insect covered with a circular scale of ashy gray color and about one-sixteenth of an inch in diameter. The young are brought forth alive; the insects multiply at an almost incredible rate and in a short time cover the bark, leaves and fruit of the infested plant. The scale is a sucking insect; a plant infested with it has no chance for growth, and little for life. A tree covered with this scale has the appearance of being dusted over with ashes. The young crawl about for a short time after birth, but the insects cannot fly, hence

they are unable to travel from one plant to another unless the branches interlace. They sometimes, however, attach themselves to other insects and are carried in this way.

This scale is one of the most destructive insects with which the fruit grower has to contend. It thrives equally well on a number of plants, including the peach, plum, pear, quince, apple, apricot, gooseberry, hawthorn, rose, spirea, maple, English walnut, elm and persimmon. The most effective treatment for San Jose and most other scales is to spray the dormant trees in late winter with the lime-sulphur wash. This is made by adding five pounds of quick-lime to about two gallons of water in an iron kettle. Boil and stir in slowly four pounds of powdered sulphur. Boil for an hour. Dilute to twelve gallons with water. This must be applied while the buds are still completely dormant.

All fruit trees should be examined every spring for scales. If any are found, the trees should be sprayed at once with a mixture of lime, sulphur and salt. The natural enemies of the scale are a small fly which is a parasite, and some species of beetle known as ladybugs or ladybirds. It is also supposed that the scales are affected with a fungous disease, but this is not definitely known.

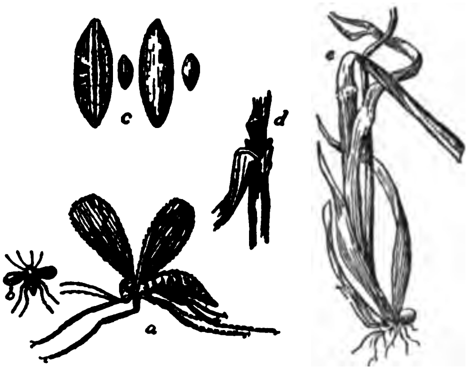
Send to the Department of Agriculture, Washington, D. C., for Circular No. 42, second series, entitled *How to Control the San Jose Scale.*

39. Other Insects. With insects as with plant diseases, those that are most destructive in your locality should receive first attention. In addition to those already named in this division, the following should doubtless receive attention: The Colorado or potato beetle, the squash bug, the striped cucumber beetle, the currant worm, the rose slug, the tent caterpillar, apple-tree and peach-tree borers, the plum curculio, plant lice, in grape and cotton regions the insects which attack these plants, respectively, and in wheat regions the Hessian fly, the chinch bug and the weevil.

INSECT ENEMIES

40. Aid to the Farmer. The farmer is not left to fight noxious insects single-handed. Nature has provided numerous enemies which lend their assistance to the destruction of these pests. Chief among these enemies are other insects, birds, those animals which feed upon insects, and certain fungous diseases whose ravages often destroy large numbers.

41. Parasitic Insects. Insect parasites consist of smaller insects which lay their eggs in the larvae of the larger. The egg hatches and the larvae of the parasite live and grow by feeding upon the tissues of the larvae upon which the eggs are deposited. In this way the larva of the host is destroyed. The most numerous family of parasites consists of the ichneumon flies. These vary in size from half the size of a mosquito to minute flies that can scarcely be seen with the naked eye. They are of great value in destroying those insects which are injurious to growing crops. The chalcis flies are also valuable in destroying the codling moth, and the tachina flies destroy the Hessian fly, one of the worst enemies of growing wheat.



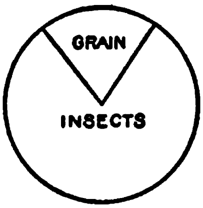
HESSIAN FLY

a, Fly, magnified; *b*, natural size; *c*, pupa cases ("flaxseeds") in different stages, natural size and magnified; *d*, barley stem, showing "flaxseeds" in position; *e*, stem bent down as a result of the work of the Hessian fly.

42. Birds. Birds are among the farmer's best friends, but often they are looked upon as enemies. On pages 20–36 of this volume you were given a plan for the study of birds. You should now have the pupils turn this suggestion to practical account by studying the economic relations of birds to man. A careful study of this plan on

a few of our most common birds will show that with rare exceptions birds are beneficial in destroying insect pests.

The nestlings of some birds, particularly of the robin, the crow and the sparrow, which in the adult stage feed to some extent upon fruit and grain, are wholly insectivorous; therefore, while at certain periods these birds may commit slight depredations upon crops, the insects which they destroy during the season would cause much greater damage.

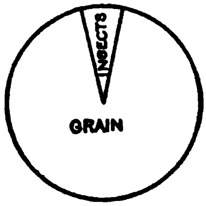


RED-WINGED BLACK-BIRD

Have the class make a study of the food of a few birds that can be observed about the home. The illustrations show the relative proportions of insects, grain or fruit that constitute the food of the adults of a few common birds. These are fairly representative of many others. They illustrate more forcibly than words the folly of killing the birds or attempting to do away with them.

(a) THE ROBIN. Let each pupil select a robin's nest that is in a good place for observation. Watch the nest for an hour at a time at different periods of the day, as morning, midday and evening. How many times are the young birds fed each hour? Make a note of what is given them at each feeding, as, earthworm, caterpillar, bug. Make the first series of observations soon after the birds hatch, the second in about a week, and the third in two weeks. Compare results. At the rate observed, how many insects would this family of robins consume during a season?

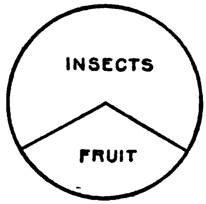
(b) THE SPARROW. The chipping sparrow is one of the most common birds about lawns and yards. Its habit of building its nest in low bushes by the side of walks makes it one of the most convenient birds to study. The chipping sparrow is easily tamed and will often come on to the porch, the threshold or the window sill to pick up crumbs. Use the same plan for study as with the robin.



ENGLISH SPARROW

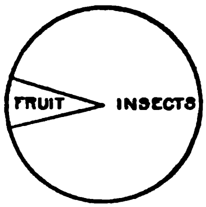
What does the chipping sparrow feed its young? Of what does the food of the adult consist? (About two-thirds of the food is vegetable, one-half of which is doubtless seeds of wild plants and the other half grain.) The young eat cutworms, weevils, crickets, grasshoppers, bugs and spiders.

(c) THE WOODPECKER. Woodpeckers are more difficult of observation. The points to be determined in their study are the extent to which they damage trees and the extent to which they prevent injury to the same trees. Some species are more injurious than others, because they drill larger holes into the tree. What is the woodpecker after when it drills through the bark? How can you find out? Why does the woodpecker strike the tree in various places before drilling?



BROWN THRASHER

By experimenting on an old tree that is of little value, the pupils can partially satisfy themselves on these points. Direct them to cut away carefully the bark around a hole drilled by the woodpecker, then by cutting the wood away carefully follow this hole to the end. Does the hole drilled meet an excavation made by a borer? Experiment with several holes. Do all of these lead to holes of borers? If not, why are the others made?



BLUEBIRD

The greatest injury which woodpeckers cause trees is in the loss of sap in the spring, which leaks out through the holes that they have drilled in the bark. The large woodpeckers which drill large, deep holes are consequently more injurious than the smaller species.

(d) THE CROW. Do crows remain in your locality throughout the year? If not, when do they migrate in autumn? At what date do they return in the spring? Why do farmers generally wish to kill crows? Is the crow the farmer's friend? How can you determine? How can cornfields be protected from crows?

At least one-fourth of the crow's diet is animal, and it eats bugs, grasshoppers, cutworms, tent caterpillars and noxious animals, such as mice and snakes. While the crow destroys some corn and fruit, in most localities it probably more than repays for this damage by the large number of noxious insects which it destroys.

Study other common birds in a similar manner. In order to satisfy yourself about the food of any bird you will have to make many observations, and probably will not arrive at a full knowledge of what the bird eats without studying it for two or three seasons. To assist in this study make a chart according to the plan here given. This plan can be extended whenever it is necessary to add another insect to the list. It is a good plan to have the oldest pupils construct charts of this kind and observe birds through the summer, then bring these charts to the school sometime in the fall term and compare notes. A star in the chart indicates that the bird eats the animal or vegetable matter named at the top of the column:

	Grain	Weed Seed	Fruit	Caterpillars	Bugs	Beetles	Grasshoppers	Ants	Spiders	Earthworms	Cutworms	Cankerworms	Small Animals	Miscellaneous
Robin			*	*		*	*		*	*				
Sparrow	*					*	*							
Woodpecker			*			*		*	*					*
Crow	*		*	*			*						*	*

43. Other Animals. The most important of the insect-eating animals of this group is the toad. Have the pupils study the life history of this little animal. In so doing they will learn how it feeds, what it eats, and many other interesting facts. Toads should be protected and attracted to

the garden. This can be done by providing moist, shady places under leaves and stones for their shelter during the day and by constructing a few little pools of water containing water lilies and other aquatic plants.

Frogs and salamanders may also be considered as insect enemies, but they are of little practical assistance to the farmer.

44. Diseases. As already noted, the San Jose scale is supposed to be affected with a fungous disease which tends to place some check upon its multiplication. A disease affecting the chinch bug has been known practically to destroy this pest over large areas in a single season. At one time it was thought that the chinch bug could be exterminated by inoculating bugs with the disease and liberating them in infested fields, but the results were not so satisfactory as anticipated. Find what diseases destroy other insects.

45. Insecticides. The following insecticides can be prepared and applied by anyone:

(a) PARIS GREEN, DRY. Paris green, 1 pound; lime or flour, 20 to 50 pounds. Mix thoroughly.

(b) PARIS GREEN, WET. Paris green, ¼ pound; lime, ¼ to ½ pound; water, 50 gallons.

Caution. Paris green is poisonous, and all receptacles containing it should be marked *Poison*, and should be kept out of the reach of children.

(c) KEROSENE EMULSION. Hard soap in fine shavings, ½ pound; soft water, 1 gallon; kerosene, 2 gallons. Dissolve the soap in boiling water, add kerosene to the hot water and churn with a spraying pump until the mixture is changed to a cream and then to a soft, butter-like mass. To get a 15 per cent emulsion, the one most commonly used, add 10½ gallons of water to the mixture.

(d) COPPER SULPHATE. Copper sulphate, 1 pound; water, 18 to 25 gallons. This mixture is useful in killing spores before foliage comes in the spring.

(e) BORDEAUX MIXTURE. Copper sulphate, 5 pounds; unslaked lime, 5 pounds; water, 50 gallons. The copper sulphate and lime should be prepared separately and then poured together. By adding 4 ounces of Paris green to 50 gallons of Bordeaux mixture, the mixture is suitable for both insects and fungi. Thus, by spraying potatoes with this combination both blight and potato bugs are destroyed.

(f) AMMONIACAL COPPER CARBONATE. Copper carbonate, 5 ounces; strong ammonia, 3 pints; water, 50 gallons. The copper carbonate should be dissolved in the smallest possible amount of ammonia and the solution kept in stock and diluted when needed.

46. Aids. *Nature Study and Life*, described on page 66, Section 45, contains valuable information and suggestions for the study of insects and diseases of plants.

Agriculture for Beginners. Burkett, Stevens and Hill. 339 pages. Ginn & Company. This is a very useful book for both teacher and pupils. The style is plain and simple, the work is remarkably free from technical terms, the subjects treated are such as everyone interested in agriculture should understand, and the illustrations are both beautiful and useful. The work also contains valuable tables and recipes.

Principles of Agriculture. Bailey. 288 pages. Macmillan Company. This work gives a clear and systematic discussion of the elementary principles of agriculture. It covers about the same ground as *Agriculture for Beginners*, but is designed for more advanced students.

How to Make School Gardens. Hemenway. 107 pages. Doubleday, Page & Company. This little work gives many valuable hints and suggestions about making the school garden and the lessons which can be taught from it. It is beautifully illustrated with drawings and halftones.

Among Country Schools. Kern. See Volume One, page 33, Section 28.

You should write to the agricultural experiment station of your state for such literature and assistance as it can furnish in the work. You will find that your request will meet with a liberal response.

Bulletins and circulars from the United States Department of Agriculture: Besides those already mentioned in the lesson, the following will be found helpful:

Circular No. 84, *The Grasshopper Problem and Alfalfa Culture*.

The Food of Nestling Birds, by Sylvester D. Judd. Reprint from a yearbook of the Department of Agriculture for 1900.

Farmers' Bulletin No. 132. *The Principal Insect Enemies of Growing Wheat*.

Farmers' Bulletin No. 146. *Insecticides and Fungicides*.

Farmers' Bulletin No. 196. *Usefulness of the American Toad*.

Farmers' Bulletin No. 243. *Fungicides and Their Use in Preventing Diseases of Fruits*.

Farmers' Bulletin No. 247. *Control of Codling Moth and Apple Scab.*

Farmers' Bulletin No. 250. *Prevention of Stinking Smut of Wheat and Loose Smut of Oats.*

Bulletin 195. *Simple Exercises Illustrating Some Applications of Chemistry to Agriculture.* United States Department of Agriculture, Washington, D. C. This bulletin should be in the hands of every teacher of elementary agriculture.

WORK BY GRADES

47. Intermediate Grades. The work in elementary agriculture in the fourth and fifth grades is so closely related to the lessons in botany and zoölogy that a separate outline is not necessary. The agricultural phase of these subjects consists in the emphasis placed upon their economic features. (See pages 67–70, Sections 47–58.)

48. Sixth Grade. This grade should receive lessons in agriculture:

(1) Testing Seeds. (Section 16.)

(2) Planning the garden (school or home garden). Deciding what to plant in the garden, and why. Care of the garden through the season. (Sections 3-6).

(3) The study of weeds. (Sections 17-20.)

(4) Selecting seeds as crop ripens. (Sections 12-15.)

49. Seventh Grade. This grade can begin the study of many of the practical problems of the farm:

(1) The study of soils. Different kinds of soil. Their formation. Fertility and characteristics. Fertilizers. Water in the soil. (Sections 7-11.)

(2) The farm crops: the kind of soil best suited to each crop. What crops are the most profitable, and why. Rotation of crops. (Sections 21-24.)

(3) Destructive insects and how to treat them. (Sections 34-45.)

50. Eighth Grade. There are so many topics that can be studied in this grade that selection is somewhat difficult. In general, the class should study the subjects which have the most direct bearing on the interest of the locality.

(1) Continue the study of insects and crops begun in the seventh grade.

(2) Study plant diseases and the means of preventing them. (Sections 25-33.)

(3) Make an economic study of one or two chief crops of the locality after the plan for the study of corn, pages 6–20.

(4) The care of stock. Dairying. Poultry raising.

TEST QUESTIONS

1. Give three reasons why the elements of agriculture should be taught in the public schools.

2. Why should the younger pupils have their plot in the school garden in common? Why should there be one or more experimental plots to be used by the school?

3. Which will hold the larger quantity of water in the form of film moisture, coarse or fine soil? Give reasons for your answer.

4. What are the chief crops in your locality? Give your plan for having the pupils of seventh and eighth grades select, preserve and test the seed for planting each of these crops the following season.

5. Why is the study of weeds of practical value? What weeds should receive special attention in your locality?

6. What is meant by rotation of crops? Show by specific illustration how rotation of crops is profitable to the farmers in your locality.

7. To what extent are the farmers of your locality conversant with successful methods of preventing diseases which attack their crops? How can you through the school assist them to a better knowledge of this subject?

8. What are the chief insect pests in your locality? Why are these insects more numerous than others common to the locality? How can the school assist in the destruction of these pests?

9. Why should pupils record their observations in agriculture in a notebook devoted to that purpose? Give a specific illustration for each reason in your answer.

10. Show how you would introduce the study of agriculture into a rural school. What objections to its introduction are you liable to meet?

LESSON FIFTEEN

GEOGRAPHY

1. Scope of the Subject. The many and widely varying definitions of geography are proof that there is a marked difference of opinion among leading authorities as to what this branch of study should include. Doubtless some of the definitions are too comprehensive, and include in geography facts and principles that more properly belong to geology and astronomy. On the other hand, such a definition as "Geography is a description of the earth's surface" is too meager, since it omits one of the very important factors in determining the science, namely, man. The human phase of geography is that which lends the greatest interest to the subject; therefore, it must not be overlooked. Hence, the truest conception of geography, for school purposes, at least, is a description of the earth's surface as the home of man. This idea should form the central thought in every subject considered, and the relation of the subject to man should be shown.

From its nature geography is closely related to many subjects, but we should always consider that it has a definite feature as a science by itself, and the branches of science to which it is so closely allied, such as botany, zoölogy and meteorology, should not be included in geography. The exclusion of such subjects will enable both teacher and pupil to get a clearer conception of what geography is and also simplify the work in that subject.

2. Departments of Geography. Geography is usually considered under three departments—mathematical geography, physical geography and political geography. Mathematical geography treats of the form and size of the earth, measurements upon its surface, its motions, and, in its broadest consideration, the relation of the earth to the sun and other bodies of the solar system. Physical geography includes

those phenomena upon which life upon the earth depends, and which, taken as a whole, constitute environment. The term *physiography* is often applied to this department of the subject. Political geography treats of man and his work. Each of these departments merits further consideration.

3. Relation of the Departments of Geography. The relation of these three departments of geography should be clearly understood by the teacher, since such knowledge enters into all plans for teaching the subject.

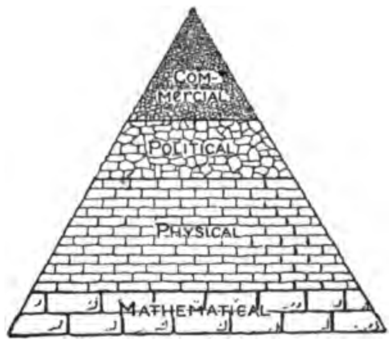
(a) MATHEMATICAL GEOGRAPHY. In the elementary course of study only such portions of mathematical geography should be considered as are necessary to give the pupils an understanding of the other departments. The form and size of the earth, its motions, latitude and longitude (Volume One, pages 356-357, Sections 13-15), include the subjects that should be considered in the elementary course. Beyond the elementary facts of each of these topics it is not safe to go, because further discussion involves conceptions and generalizations which are altogether too abstract and too difficult for pupils of grammar school age.

(b) PHYSICAL GEOGRAPHY. Physical geography is really the foundation of the subject for school purposes, and the teacher should have a thorough knowledge of this department of the science. That knowledge should include the great facts of physical geography, such as the facts of relief; the relative positions of the great land masses and oceans; the underlying principles and laws of climate; the effect of climate upon life; the distribution of life, both vegetable and animal, and the effect of all these on man and his work.

The teacher should have a few illustrations of these facts well thought out, and be able to apply them as needed. The following are good examples: comparison of the temperature at the foot of a mountain and on its summit, on a summer day; comparison of the climate of the British Isles with that of Labrador, and the comparison of winter

in Maine and in the state of Washington. Comparison of animal and vegetable life should also be made in a similar manner.

While these great facts and their relations to each other and the laws upon which they depend must be understood by the teacher, the systematic study of physical geography should not be attempted below the high school. The truths which the pupils in the elementary school need to know should be taught as facts as occasion requires. The causes for the phenomena discussed can well be deferred until a later period.



DEPARTMENTS OF GEOGRAPHY

(c) POLITICAL GEOGRAPHY. Political geography treats of man and his work. This has the greatest interest for pupils, and properly occupies the chief attention in the geography work of the elementary grades. The relation of political to physical geography, and its dependence upon that department of the science, are brought out and emphasized in the method of treatment of the subject. We cannot study the geography of any race or nation without studying its environment and seeing how that environment has affected its social, political and industrial life. Therefore, the desired end is reached in the most satisfactory manner by using political geography as the center of instruction, and relating to that such facts in physical and mathematical geography as may be necessary.

(d) ECONOMIC GEOGRAPHY. The world's industries have assumed such vast proportions, and are, through modern means, so closely linked together, that they constitute a department of geography a knowledge of which is of the utmost importance. Economic geography includes a study of the industries and commerce of the world and their

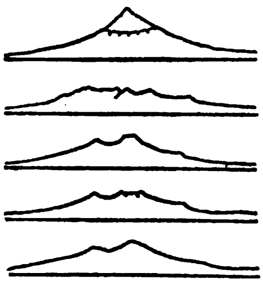
economic relations to mankind. It is also known as commercial and industrial geography.

4. Purposes. The chief purposes in teaching geography are (1) to give the pupils a knowledge of the facts of geography found in their immediate vicinity, such as the animal and vegetable life, and the occupations with which they meet every day; (2) to lead the pupils to understand the underlying principles and laws of geography, such as the laws governing temperature, rainfall and the distribution of life; (3) to lead the pupils to apply these laws and principles in determining geographical conditions of places with which they are not familiar by experience; (4) to lead pupils to see how geographical conditions control the customs, habits and occupations of men; (5) to enable the pupils to see how and to what extent man has affected geographical conditions, as by the construction of canals, by irrigation, and by denuding large areas of forests; (6) to create an intelligent interest in the great world and its activities.

5. Preparation of the Teacher. "Teachers cannot teach that which they do not know. If teachers know little else but mental pictures of maps and an isolated mass of conglomerated facts, they cannot teach geography." Many superintendents and principals from their experience realize the truth of this statement. Doubtless more teachers fail to secure the desired results in their geography work from lack of sufficient preparation than from any other cause. The broad field covered by geography and its relation to numerous other branches makes a thorough preparation on the part of the teacher an essential to success. This preparation should be along the following lines:

(a) GEOGRAPHY. As already stated, it is not enough for the teacher to know simply the facts of geography, such as the names and locations of places and capitals and the boundaries of states and countries. She must understand the principles and laws of the science and their application, for instance, such as the relation of altitude to temperature, the relation of winds and altitude to rainfall, the principles

governing the distribution of life, both vegetable and animal, and the relation of all these conditions to man and his work. The teacher must have a general idea of how the progress of the race has been determined by geographic conditions, and she should understand how such conditions affect the industries of her immediate locality and of the country at large, so that she can explain why the people in Dakota raise wheat, those in Montana raise live stock, and those in western Pennsylvania engage in mining and the manufacture of iron and steel. She should also be able to give the geographical reasons for the location and size of the chief cities of the world, such as London, New York, Paris, Calcutta and Hamburg, and to show why the great lines of transportation have been located where they are. Above all, she should be able to give the reasons for the customs, manner of life and forms of government in the leading nations of the world.

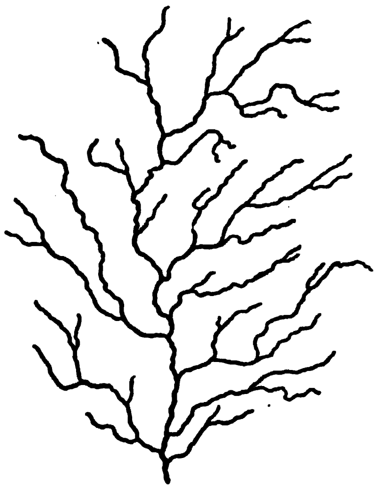


OUTLINES OF MOUNTAINS

(b) Elements of Natural Science. The intimate relation which geography sustains to physics, botany, zoölogy, geology, meteorology and chemistry makes it imperative that the teacher have a knowledge of at least the elements of these sciences, for without this knowledge she cannot make the application of the fundamental principles and laws of geography, nor will she be able to work out or understand these principles. A good text-book in each of these subjects should form a part of every teacher's library.

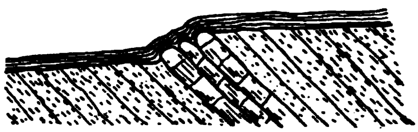
(c) Descriptive Power. Much of the pupil's knowledge of geography must be obtained through descriptions, and the teacher should be able to give vivid and accurate descriptions of people and places. If she does not possess this power naturally, she can acquire it by study. (Volume One, pages 278-280, Section 3.) She should also be able to use the blackboard. McMurry says, "The teacher who cannot

use the blackboard freely for illustrative purposes is shorn of half her strength at the start." This does not mean that the teacher needs to be an artist, but that she must be able to make simple sketches similar to those shown in the illustrations and, to do this with ease and freedom, so she can use the crayon at the same time that she is giving verbal descriptions. The illustrations of the outlines of mountains, a river system and the formation of rapids and cataracts show what any teacher ought to be able to do in the way of blackboard illustrations in geography.



A RIVER SYSTEM

(d) THE TEXT-BOOK. The teacher must know the text-book from a teacher's point of view. No text in geography can be followed absolutely, and many texts are unsuitable because of their plan and subject-matter. The primary geographies are usually the most difficult. All of the older books attempt to give a systematic treatment of the subject; therefore, their contents comprise a mere skeleton of maps and facts. Some of the more recent books are a great improvement upon the older ones, but even the authors and publishers of these have been too fearful of breaking entirely away from old traditions to produce books best suited in all respects to the needs of the children. Nearly all text-books contain too many petty details and fail to give sufficient space to the great facts of geography.



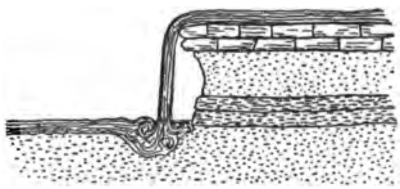
THE FORMATION OF RAPIDS

Concerning these works, one of our leading authorities says:

"The crucial test of the value of the text-book in geography is not so much what it contains as what it doesn't contain. A text in which the fundamental principles have been scuttled and sunk in a sea of irrelevant details may have a cyclopedic value, but it is not worth much as an educative factor. * * * The text of the ordinary advanced geography contains about fifteen hundred geographical names and the maps about five times as many in addition. As a matter of fact, the average man or woman of intelligence is rarely familiar with more than three or four hundred geographic names, even in a very general way."[1]

It is, therefore, important that the teacher get a clear conception of the scope and plan of the text-book before it is introduced into the class. Such a conception can be obtained only through a comprehensive study of the book from beginning to end. It is not enough to keep one or two lessons ahead of the class; the teacher who attempts to use any text-book in geography in this way is sure to meet failure.

(e) LITERATURE. Many localities are rich in legends, historical incidents and literary allusions. The teacher should know where to find these, and how to use them to the best advantage. A method for collecting and arranging such selections is given in Section 21.



THE FORMATION OF A CATARACT

(f) KNOWLEDGE OF THE WORK AS A WHOLE. The teacher must be able to see the end from the beginning, otherwise she cannot plan wisely; even in those schools provided with complete courses of study this is necessary. The teacher must determine what she will accomplish each week and month; what points need special emphasis, and what can be passed over lightly or omitted altogether. With a definite plan of this kind before her, she may so direct the

[1] Redway: *New Basis of Geography.*

study of the pupils as to keep them interested and at the same time prevent waste of effort.

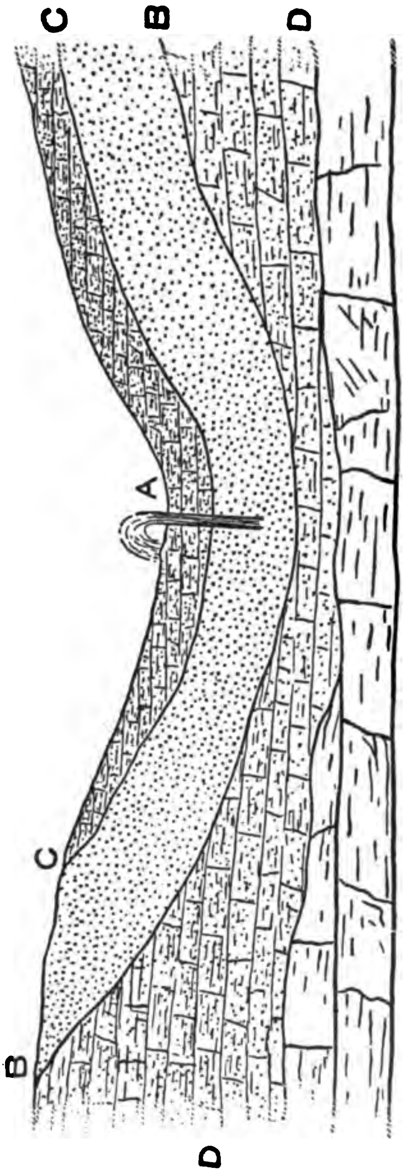
6. Conditions. In many schools pupils begin to study geography from the text-book when they enter the fourth grade. In most cases the pupils would probably acquire a better knowledge of the subject if the study of the book were deferred until the middle of the fourth year, or the beginning of the fifth; but teachers have to take conditions as they find them. If pupils have received proper training, when they enter the fourth grade they should know the names and uses of the plants and animals common to their locality; something about the migration of birds, and be able to recognize the most common birds; the occupations of the neighborhood, and the necessity for them; the coming and going of the seasons; the direction of the winds; the difference in the length of day and night in summer and winter; something about erosion and the transportation of eroded materials, and they should recognize the home as the center of life. They should also have made a study of the schoolgrounds and the immediate surroundings. If the class is strong, this study should have been extended to include the school district; if the school is in a village, the study should have included the village.

The pupils should know what a map is, from drawing maps of the localities studied, and they should have learned the meaning and use of a scale. They have probably also become acquainted with the chief articles of food and clothing Unless they have had at least this preparation, they are not in a condition to begin the study of any text-book in geography, and the teacher will need to do considerable preliminary work.

Whatever the previous preparation of the pupils may have been, the text-book should not be wholly set aside, if pupils have been provided with copies. Many parents are not easily convinced that their children are learning anything of value unless they use books. Moreover, if the pupils have brought their books to school, they will be

sadly disappointed if not allowed to use them; therefore, the teacher is under the necessity of making the best use of the book that she can.

7. Home Geography. Regardless of the introduction of the text-book, the study of home geography should be continued. The importance of this phase of geography work is too often underestimated. It should have a regular place on the daily program and be given its full share of time. Home geography lays the foundation for the study of foreign geography, because through it, and through it alone, can pupils obtain concrete illustrations of ideas which enter into their concepts of geographical forms. The oral lessons should be continued and elaborated, provided the



AN ARTESIAN WELL

BC represents a layer of gravel or porous earth saturated with water. A and D represent layers through which the water cannot pass. When the well is bored at A, the pressure of the water from the higher level in BC forces it up through the pipe and forms a flowing well.

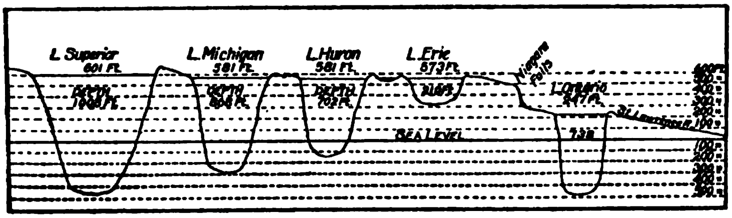
pupils have a knowledge of the subjects named in Section 6. A study of the features of the landscape forms a good introduction to the work of the fourth grade. In almost every locality springs, brooks or rivers, swamps and prairies, or hills, valleys and meadows can be found. The leading features of the surface of the locality can be used to excellent advantage and should always be drawn upon to furnish concrete illustrations of descriptions found in the text-book. The same use should be made of plants and animals, the most important crops, the chief industries, and the lines of transportation of the locality.

The study of a railroad naturally leads to the consideration of some of the towns and cities through which it passes, and in this way the pupils begin to extend their knowledge of the locality. A brook or river has almost limitless possibilities. The constant changing of the banks, the character of the bed, where the current is swift and where it is slow, the deposit of sediment in some places, and the wearing away of the earth in others, afford excellent illustrations of erosion and the formation of alluvial or flood plains. By tracing the divides and slopes of a small stream, the children soon learn the area drained by it, and thus get a concrete illustration of its basin, which needs only to be enlarged by their imagination to apply to a river basin. Mountains, hills, valleys, prairies and other natural features can be studied in the same way.

The occupations of the locality are equally helpful. They are types of great classes of industry that are found over the country and over the world. Thus home geography serves a double purpose; it causes the pupil to become acquainted with the geographical facts of his locality and also brings him in contact with types of great geographical facts which he follows throughout the study of the subject.

The connection of these lessons in home geography with the text-book is easily made by having the pupils read from their geographies descriptions of objects like those they are studying, then asking them to discover in what respects the

description must be modified to fit the object to which they wish to apply it. By such exercises the pupils soon learn that the main facts in the printed description will apply to local objects, but that details are different for each hill,



ALTITUDES AND DEPTHS OF THE GREAT LAKES

valley, river and other object studied. In this way the class becomes acquainted with the broad application of the general truths of geography.

8. Study of the World. As soon as the pupils become acquainted with their text-book and form some conception of what geography is, they should be taught something about the world as a whole. The form of the earth is best taught by the use of a small globe or an orange. At this stage a number of small globes which the pupils can handle are much more useful than a large, mounted globe. The conception of the rotundity of the earth is difficult for children; even some adults never get a clear idea of this fact. If the earth is round, why does it always look flat or mountainous? is a question constantly recurring in the child's mind. With a small globe or an orange this difficulty can in a measure be explained away. Have the pupils take a piece of paper large enough to cover at least half the globe, and in the center of this cut a round hole about one-half inch in diameter; then lay the paper on the globe so that the part in which the hole was made touches the surface. How does the part seen through the paper look? Why? Explain that the portion of the globe seen through the hole in the paper is relatively much larger than any portion of

the earth that we can see at one time. Some of the simple proofs of the earth's rotundity, especially that of seeing ships enter and leave the harbor, should also be explained. Hemispheres, the division of the earth's surface into land and water, the names of the continents and oceans, their relative position and general forms should also be taken up in connection with this first study of the world as a whole. Only the most striking general features should be touched upon, but these should be given sufficient attention to fix them firmly in the minds of the pupils.

9. Selection of Topics. After the pupils are started in their work, the teacher should exercise her best judgment in the selection of topics, whatever the plan of the book that she has to teach. Two pitfalls should be avoided: attempting to teach a multiplicity of details which to the pupil form no part of the general whole and which obstruct or wholly prevent his comprehending the general effect, and attempting to lead pupils into special lines of observation which are of interest to the teacher, but from their nature cannot interest pupils of immature minds. Children can grasp simple wholes, even when they are large, but they cannot analyze complex subjects. The teacher should always bear this in mind in the selection of her topics. Another guiding principle is, "The number of classes of geographical facts is not great, while the number of individuals in each class is legion." The selection of a few important representative class topics is therefore of much greater value than the study of any amount of detail.

The following topics will be found suggestive: (1) Those topics which are fundamental, and run through all the grades; as climate, erosion, forms of water, relation of industries to location, commerce and government. (2) Topics of interest in the immediate locality; as the hills, streams and valleys, the leading industry of the district or town, the courthouse, the city or village hall, a railway station. (3) Special topics: places of historic interest, such as Gettysburg, Lexington and Concord; places of remarkable scenic

beauty or grandeur, as Niagara Falls, Yellowstone Park, Yosemite Valley.

By confining the study to a few significant topics which have a bearing upon the work of the entire course, enough time can be devoted to these topics to make them real and lifelike. The teacher must remember that mere memorizing of facts is not knowledge. A fact in geography has no value to the pupil unless it has some significance for him; that is, unless it points to something that he knows from experience. The topics selected for the class beginning the use of the text-book should be simple and should bear a close relation to some of the home geography topics referred to in Sections 6 and 7. Some of the topics should also correlate with the history stories studied at this time. See page 165, Section 13.

10. Study of a State. Some of the most successful teachers of geography advocate devoting at least the first half of the fifth grade to the study of the state in which the school is located. These teachers claim, and with good reasons, that the state is a unit large enough to embody many of the principles which the children are becoming conscious of in their study of home geography, and to show the interrelation and application of these principles to life; and that the study of the state gives the child an understanding of the meaning of geography which he will not gain if he passes immediately from home geography to the larger outside world. The state is also typical of a country, and when the child obtains an idea of the state, as a political unit, this idea needs but little modification to adapt it to a country. Most courses of study recognize the importance to the pupil of a knowledge of the state in which he lives, and make ample provision for state geography.

In the fifth grade extent, outline, and large, graphic features should be studied. These should include the chief mountain ranges, principal rivers and other bodies of water, prairies, plains and large valleys, if they are found, and the location and extent of the natural resources.

The leading industries and occupations and the chief centers of trade and manufacture should also receive attention. The study of these will naturally lead to the study of transportation. The leading lines of railway should be traced upon the map, and the most important railway centers located. Similar lessons should be given on navigable rivers and canals, if any are found within the state.

In the last part of the year a few lessons on the government of the state should be given. The capital should be located; the plan for electing the state officers, and the general duties of some of the most prominent of these officers should be discussed. The election of legislators and the making of laws should be touched upon, as should the courts and their duties.

The work should be upon the same plan as that used in the study of a country, then when the class changes from one unit to the other there will be no occasion for confusion.

11. Oral Instruction. Text-books are but guides in the study of any subject, and without exception they should be supplemented by oral instruction. Pupils in the intermediate grades need a great deal of oral instruction, because they have not arrived at that stage of maturity which enables them to interpret fully what they read. Teachers are often deceived by the fact that pupils read a book readily. It does not follow that they comprehend the meaning of what they read. Whether or not they are able to do this can easily be determined by asking them a few pointed questions upon the subject-matter. An elementary geography presents many difficulties to the child. It contains a large number of new words, its style is different from that of other books that he has read, and its arrangement is often such that he is unable to see in it any plan or purpose. If he is to master this book he must receive such instruction as is necessary to enable him to overcome these difficulties.

Another reason for oral instruction in geography at this time is that these lessons should contribute to the development of the pupil's memory, imagination and reason. Pupils

at this age grasp more clearly and remember much better such facts as are presented to them in oral lessons. One reason for this is that the teacher can enter much more fully into the description of places than it is possible for the text-book to do. These vivid word pictures, supplemented by suitable blackboard sketches or other illustrations, give the pupils a clear mental picture of the object described. The oral description also holds the pupil's attention much more closely than the printed page.

Again, oral instruction affords opportunity of presenting problems for the pupil to solve which the text-book cannot contain. In the study of the lumber industry, for instance, the pupil should be given time to solve such problems as how the lumbermen get the logs to the mills and how the lumber gets to market. The Southern farmer has a large crop of cotton. What steps must be taken to exchange his crop for money? These and similar questions constantly arise in the discussion of geography topics. The solution of some of the problems found in such questions will require but a moment, while that of others will require so much time that the answers must be deferred until a future recitation. By injecting such problems into the recitation, the pupils are thrown upon their own experience; arriving at the solution not only strengthens their reasoning powers, but it also helps them to make a vital connection between the geography lessons and their daily lives. (See Volume One, pages 248-252, Sections 10-11.)

The amount of oral instruction which is directly related to the lessons in the text-book will, of course, depend upon the pupils' preparation for the book before it is introduced. Pupils who have done the work outlined in Sections 6 and 7 will require less than those who have not had such preparation. During the first year that the book is used considerable oral instruction will be necessary, such reference to the text being made as will enable the pupils to connect the lessons with the book. With each succeeding year the time spent in studying the text will increase, and that devoted to oral

instruction will decrease proportionately, since pupils are constantly growing in their power to master books. However, the successful teacher of geography will never cease to supplement the text with oral instruction whenever she feels that this work is needed.

PREPARATION. Oral instruction in geography requires extensive and thorough preparation on the part of the teacher. She must have such a knowledge of the subject to be presented as will enable her to make it real and lifelike to the pupils. For steps in the preparation of an oral lesson, see pages 162-165, Section 12. The directions for a history lesson apply as well to lessons in geography. But the teacher should be a keen and close observer. Geography at first hand is written not in text-books and works of travel, but in the great book of nature, and she who would be successful must read this book and develop a love for its teachings.

Cautions. (1) Geography deals with a large number of subjects which are also treated in other sciences, such as botany, geology and meteorology. In no subject is there greater danger of digression from the topic at hand. Therefore, remember that geography treats its topics from a *geographical* point of view; that other sciences treat them from a different point of view. *Stick to the text,* and avoid confusing the pupils by the introduction of irrelevant matter and unnecessary details.

(2) Do not attempt to cover too much ground, but weave a large number of interesting details around a few central topics.

(3) Do not talk too much in oral work. Ask a few pointed questions which will lead the pupils to observe and to think. When they have learned what they can, supplement their efforts with such clear, concise descriptions and explanations as are necessary.

12. Excursions. Excursions are of two classes—real and imaginary. Those of the first class consist of trips that the class and teacher make to nearby places. Those of the second class consist of imaginary journeys that the pupils

make to distant cities, other parts of the country and foreign lands.

(*a*) REAL EXCURSIONS. Excursions afford opportunity for the study of types, and should constitute a part of the work in home geography. The excursions should be planned with reference to available places and to the season of the year. During the winter, where the climate is severe, they should be confined to objects within doors, except on rare occasions. In the South excursions to outdoor points can be made throughout the year. The plan for the term or year should also give as much variety as the pupils can use to advantage, such as the study of the features of the landscape in the neighborhood, of some of the different manufactories and one or more stores. Local conditions vary to such an extent that specific selections cannot be given.

The excursions should be carefully planned. If possible, the teacher should visit each place beforehand, and if the excursion is to a manufactory or store or any other business with which the visit will possibly interfere, permission to visit the place should be obtained from the proprietor or manager. In her visit to such a place the teacher should, if possible, go over the ground with the foreman or someone who is thoroughly familiar with the different departments and their relation to each other. At this time she should determine what she wishes the pupils to study and then plan her trip through the building so as to have the class see the various departments in their proper order and relation. Unless this precaution is taken, at least one-third of the value that should be obtained from the trip will be lost.

The pupils should be told one or two days before the excursion is to take place what is to be done, and they should obtain the consent of their parents to go on the trip. If the excursion is to a factory or any place where machinery is in operation, only a small number of pupils should be taken, unless the teacher can have a number of assistants from the older pupils or patrons who will take charge of

the children in small groups; otherwise, serious accidents are liable to happen. The pupils should be kept together, and their attention should be directed to what the teacher wishes to have them see. Unless this is done, very much will be lost because of the confusion arising from the novelty of the place and the many things which tend to distract the children's attention. With classes in the lower intermediate grade, attention should be directed only to the most important features of the work. With older classes such details can be added as they will understand. It is well to have the children ask the proprietor, or foreman, questions; or for the teacher to ask the questions in the presence of the class, so they can hear the explanations The excursion should furnish material for two or three lessons, and the work should be completed by having the pupils give first a complete and connected oral account of what they have seen, and then a written account of the same. (See Volume One, pages 248-252, Sections 10-13.)

If a house or other building is being erected in the neighborhood, encourage the children to watch the progress of construction. Inquire after the source of all the material that goes with the building, and trace each kind of material back, if possible, to its original source—the farm, the forest, the mine and the quarry.

Excursions are attended by certain difficulties which the teacher should foresee and overcome. These are the difficulty of controlling children out of doors or in strange places, the tendency of some of the children to give their attention to trivial matters and those things which are in no wise connected with the point in hand, and the opposition which some parents raise to the proposed scheme. Such opposition is usually genuine on the part of the parents who entirely misconceive the purpose of the trip and do not understand how pupils can learn unless they are in school studying books. A visit to the parents and an explanation of the purpose and work will usually remove their objections. One or two talks with the pupils before the first excursion, giving them an

understanding of what is expected of them, will usually prevent in a great measure the other difficulties.

(b) Imaginary Excursions. This method of study affords considerable variety in the geography work and is of particular interest to pupils in the fifth and sixth grades. Such excursions should begin with imaginary journeys to places near by, which some of the pupils may have visited. If the school is in the country, an imaginary excursion to the town where the community transacts most of its business will make a suitable beginning. Another can be taken to the county seat, and another to the nearest large city or the large city with which the community is most closely connected through its business relations. This work can, of course, be extended to various parts of the United States and to foreign countries. The danger is that it may be overdone. Not all study in geography should be taken up in this way, but the trips should be planned whenever they will serve the purpose of a good review or lend additional interest to the work which the class is doing.

Imaginary excursions should be planned with as great care as real excursions, and they should be made as real as possible. The distance to the point to be visited, the best means of travel, the most important objects to be seen, the habits and customs of the people, the various industries in which they are engaged and other matters of interest should be carefully considered. Books of travel, text-books, and especially the elaborate circulars issued by the leading railway and steamship companies, should be consulted by both teacher and pupils in the preparation for these journeys. Great assistance can be derived from pictures. The school that has a stereopticon with a valuable collection of slides, is fortunate, but the stereoscope, and pictures without the use of a lens, add interest and give valuable information.

(c) Letter Excursions. Correspondence between pupils in the geography class of one school with those in a similar class in another school far distant can sometimes be arranged, and it adds very much to the value and interest of the work.

Any teacher desiring to introduce such a feature into the geography work, especially in connection with these excursions, should write the superintendent or principal of the school with which she desires to institute correspondence. If the plan is accepted, then certain pupils should be designated to correspond with those that may be named by the teacher in charge of the class in the other school. The pupils should describe such objects and conditions in their locality as they think will be of interest to their correspondents, and the letters which they receive will contain similar information. The teacher should have oversight of this work to the extent of suggesting the information that should be given and requested. These letters become the property of the class and are read in the recitation by those receiving them, so that all can have the benefit of the correspondence. Different pupils can be appointed to conduct the work from month to month, as long as it is desired to continue the plan.

13. Maps. The first idea that the term *map* usually conveys to one is a conventionalized representation of the whole or a portion of the earth's surface. The map may include only the schoolgrounds or it may embrace the whole world. Between these two extremes there are unlimited gradations. The school work in geography usually requires the pupil to study three classes of maps—political, physical and relief.

(a) Political Maps. The first maps which the pupil studies are those from which he gets his first conception of what a map is. They contain contour, direction, and whatever other facts it is considered desirable to place upon them. If the first map is of the school grounds, those following it can be extended so as to include the locality adjoining these grounds; then they may take in the township and even the county; but such map work should not be carried too far. If the school is in a village, a map of the village which shows the principal streets and any public park or other prominent features may be attempted, but maps of large towns and cities should be avoided at this time. In case maps of the county are studied, they should contain only the chief feat-

ures, such as the principal towns, most important highways and leading railroad lines.

When the pupils make the transition from home geography to that of the world they begin to study maps representing continents and countries, and a set of wall maps is indispensable. These maps should be simple and clear, bringing out only the most important features.

(b) Physical Maps. Physical maps represent the surface of the country in relief. There are two kinds of maps used for this purpose: those which represent the various altitudes by difference in color, and those showing relief forms by such shading as will represent highlands and lowlands. Each of these classes of relief maps has its ardent advocates, and the best geographers seem to be about equally divided as to their merits. For the younger children especially, a shaded map which shows highlands and lowlands in relief form is more desirable than one showing these forms by difference in color, because the children are unable to image the forms represented in this way. It is also quite probable that clearer ideas of relief are obtained by the use of this class of maps throughout the grades in the elementary schools, notwithstanding the fact that some of our best textbooks use the other form.

(c) Relief Maps. True relief maps are really models of the region represented so as to show the surface approximately as it is found. Such maps are of great value in giving pupils a conception of the general structure of a continent or country, but in order that they may accomplish this purpose the pupils need at the beginning to have a concrete illustration of what such maps represent. This illustration is easily obtained by having the pupils, with the teacher, model a region near the schoolhouse. If a small stream is in the vicinity, a portion or the whole of the basin drained by this stream can thus be modeled. A hill, a railway cut and a road passing over a hill and through a valley also afford good illustrations of regions that can be used to advantage. If the pupils begin construction of relief maps with some-

thing of this kind, they see at once what the map represents, and when they model a continent the form is much more real to them.

Various materials can be used in making relief maps, such as sand, putty, and papier-mache. If the schoolroom contains a sand table, or if proper molding boards and a quantity of fine sand can be obtained, perhaps this is the most convenient and least expensive material that can be employed. Its manipulation, however, requires more skill than that of putty or papier-mache. The papier-mache is probably the most available material, because it can be manufactured on the spot at little or no expense. Take a quantity of old newspapers, tear them into small pieces and soak them in water into which a solution of gum arabic or mucilage has been poured, the proportions being about a tablespoonful of mucilage to a gallon of water. After the paper has soaked several hours, it can be made into pulp by working it with the hands or stirring it with some implement until it is thoroughy macerated. When needed for use it should be taken from the pail in small quantities and have all of the surplus water squeezed out. Newspapers thus treated form a very plastic material, having a gray color. This can be easily worked, and the mucilage causes the pulp to harden and become firm as it dries.

Whatever material is employed, the construction of the map should be planned before the work is begun. Each pupil should draw upon the molding board, or other surface upon which the map is to be made, an outline of the continent or country. This will enable him to bring his map into proper form as he constructs it. Most of these maps are too complex to admit of completion at one period; hence, the work should proceed in sections from day to day. The work is most easily done by modeling the principal mountain ranges, then arranging the coastal plains and interior lowlands. Large forms are most easily modeled, so it is evident the continents do not present so much difficulty as a country or state.

(d) Map Reading. The teacher should be able to understand all the markings on the map and margin. The children must learn direction; the meaning of the scale and how the scale is used to determine distance; the meaning of parallels and meridians; the irregular coast line with its projections and indentations; the location of the mountains, lowlands, lakes, rivers, cities and other prominent features; and their attention should be called to the various markings that represent these different features until they become thoroughly familiar with them. The pupils of the seventh grade should also learn to read the margin of the map, and from this find the latitude and longitude of places.

It is difficult for children to form correct mental pictures of the objects which these markings represent. The use of pictures in connection with the study of the map affords one of the best means for connecting the map with what it represents. If the class is studying the map of Colorado, for instance, views of Pike's Peak, Cheyenne Canyon, the Garden of the Gods, Royal Gorge, and general views of the mountains, show what the marks indicating mountains actually represent. Making relief maps of a locality is another excellent way to help pupils make the connection between the map and the object. Both plane and relief maps of the locality should be constructed, and the teacher should continue supplemental instruction until the features represented upon the map become realities. Philadelphia should not be a mere dot, but a great city, throbbing with life and containing many spots of historic interest. Pike's Peak should be a great mountain, lifting its summit above the clouds and having its sides covered with loose, irregular fragments of rock. The black line crossing the United States from north to south should be the great river, with its changing banks bordered by fertile fields and bearing upon its bosom the commerce of great states. Pupils will not see these things without help, and any device that will enable them to picture what the map represents, is good.

(e) MAP DRAWING. Map drawing is one means of expression; when properly used the art gives the pupil additional

OUTLINE MAP

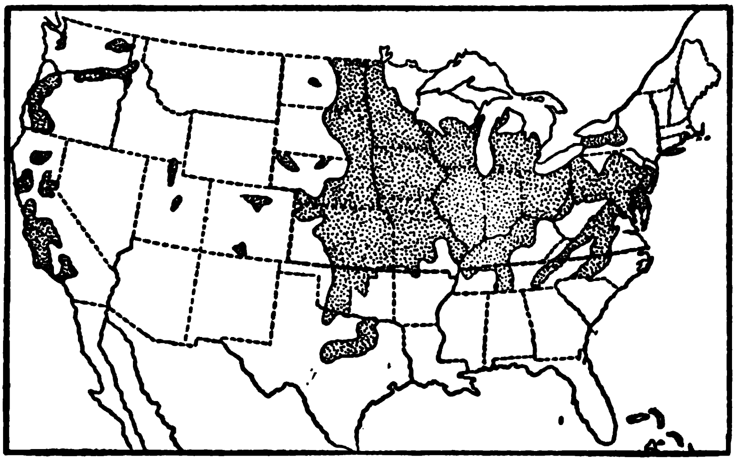
power and enables him in a few minutes to give a better idea of what he knows about a country or other locality than will any amount of questioning. Map drawing is entirely distinct from map modeling. While in a few instances highly finished maps which require the expenditure of a great deal of time may be of sufficient value to warrant their construction by pupils who have a special aptitude for that kind of work, in general they should not be attempted. The simple outline map which can be produced rapidly and with a few strokes with the pencil or crayon, is by far the more valuable for class work. With a little practice most pupils become quite skilful in the construction of such maps. Occasionally text-books contain elaborate systems of construction lines for drawing maps. These should be avoided. The time required for drawing the plan is often greater than that necessary for drawing the map. The only construction lines of value in case any are needed, are those representing the parallels and meridians. These the pupils can soon learn to draw, but it is usually better to have them study the map carefully and then draw without guiding lines of any sort. In this work the chief aim is not perfection in outline but the acquisition of ability to express form and location.

Printed outline maps are now furnished by a number of publishing houses at a nominal cost, and these can be used to good advantage in making progressive maps, both in geography and history. The outline is accurate and the time necessary for making this is saved. The maps can be filled

in as the lessons proceed. These maps are also useful in locating the various industries in the country, as lumbering, the raising of wheat, the raising of cotton, and coal mining. Usually it is best to have the map represent only a single industry; by this plan the fact studied is strongly emphasized.

OUTLINE MAP OF CALIFORNIA

(f) MAP STUDY. Pupils should be trained in the study of maps until they have formed the map habit. By this is meant the habit of looking up on the map the location, relative area, distance, and other geographical data of places about which they read or study, unless they already know these facts. It is of great advantage to one to be able to bring into mind the map of any country or other region at



WHEAT REGIONS OF THE UNITED STATES

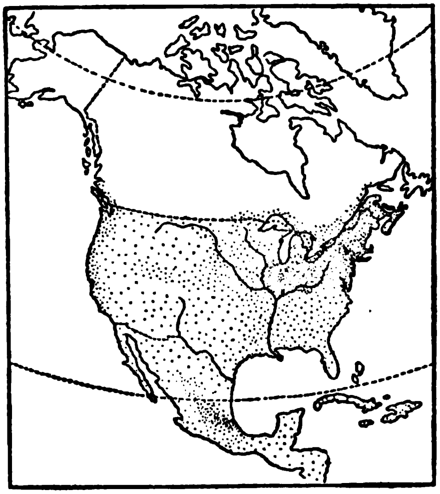
will. This is a kind of knowledge that the business man finds of use in commerce, and another kind is that which is closely related to it, namely, the ability to recall along

with the map the physical and political conditions of the region which it represents. The map as a representation of the location of a country also represents its surface, climatic conditions, products and people. When all of these facts are associated with the map they make it mean vastly more than a patch of color, and each added fact helps to fix the map in mind.

The map habit is formed only by persistent practice. Have a map where it can easily be consulted in the geography recitation and require pupils to point out upon it the places named as they recite. Require pupils also to look up on the map all places mentioned in the reading lessons, history and other subjects. Require occasional map sketching and in every way possible lead the pupils to realize the value of maps, but do not give map exercises which require the mere searching out of the location of places and tracing of boundaries of political divisions. These facts should be learned incidentally; exercises of this variety are lacking in interest and are thoroughly distasteful to the pupils. An excellent exercise is to have one of the pupils read a few important news items from a daily or weekly paper and let the class locate the places named without referring to the map. After the last item has been read, the maps can be consulted. An occasional exercise of this sort is of far greater value than any number of stilted map lessons.

Caution. Do not attempt too much. Map location forms only a small part of the work in geography, but it should yield clear, definite and permanent results. Children should know the essential map locations, and know them well, such as the location of Boston, New York, Philadelphia, Chicago, the Mississippi River, the Rocky Mountains, the Mediterranean Sea and the Suez Canal. They should know the location of the different states in the Union, and of the leading countries, bodies of water, and cities of the world. In learning these facts they should learn how to find upon the map the location of any other place it becomes necessary for them to know.

(g) GLOBES. Every school should have a globe. The most useful globe is a small, inexpensive one which can be handled with ease and safety by the pupils. Elaborate pieces of apparatus of this kind usually contain so much that they confuse the younger children. Only a few things should be attempted with the globe in elementary geography. These are the study of the form of the earth, of the relative positions of the continents and oceans, the cause of day and night, as shown by the rotation of the earth, and an understanding of the meaning of parallels and meridians and their position. Most of these facts the pupils will discover for themselves, provided their attention is directed to them by the teacher and they are allowed to handle the globe in obtaining answers to the questions. Many teachers make a mistake in attempting to solve problems with the globe which are entirely too difficult for elementary pupils.



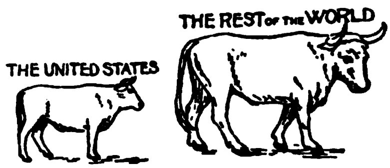
DENSITY OF POPULATION

14. Graphic Illustrations. Statistical data when expressed in figures mean but very little to the average adult and practically nothing to children. The comparative extent and value of our great industries, the value of our exports and imports, also of our trade with the leading commercial nations and the relative position of the United States among the leading nations in area, population, agriculture, manufacture, commerce and other important matters, are facts that pupils should learn during their study of elementary geography, but some other means than the use of

figures must be employed to impress these facts upon their minds. If we say that the wheat crop of the United States for 1906 was 735,260,970 bushels, the statement conveys no definite idea to the class, but if we tell them that were the entire wheat crop of 1906 collected into one huge pile, the wheat would fill a trench 141 miles long, extending from Albany to New York, and 35 feet wide and 35 feet deep, we have given them a standard of measure which they can at least partially comprehend. If we go further and illustrate the statement by drawing a map showing the location of the cities named and the length of the trench extending from one to the other, the size of the wheat crop is brought before the pupils still more forcibly, and most of them will remember the fact thus presented.

THE WORLD'S WHEAT CROP

Another good illustration is found in the meat packing industry. The number of hogs slaughtered in the United States annually is about 31,000,000. They have a gross weight of 930,000,000 pounds and yield a net weight of dressed meat of nearly 465,000,000 pounds. Could all these hogs be combined into one huge animal, it would have a length of 1570 feet, or it would extend nearly across three city blocks, while its height, 785 feet, would exceed that of the tallest building in the United States by more than 160 feet. The quantity of the various products can be illustrated in a similar manner; for instance, the sausage made, if formed into a continuous chain, would make a chain that would extend more than six times around the earth. Draw an outline of the globe and run this chain

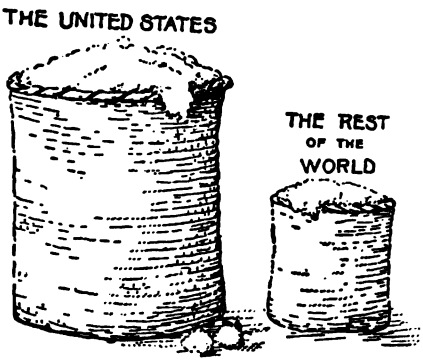


THE WORLD'S MEAT SUPPLY

around it six times, and the children will never forget the illustration.

The ingenious teacher will be on the watch for devices for illustrating statistical matter. The *Scientific American*, from which the accompanying comparative illustrations are taken, publications of the Census Bureau and articles in periodicals often contain valuable suggestions for devices of the kind just named. The teacher should also have at hand a number of simple, conventional devices which are easily made. By means of these the comparative areas of continents and countries, length of rivers, population of cities and many other important and interesting facts can be graphically represented. The circle, the rectangle, the line and the pyramid are the simplest and most valuable devices, and any one of them can be used with the older classes. However, pictures similar to those described in the illustrations above are more valuable for the younger classes. The use of colored crayons also helps to make the impression more vivid; for instance, if the teacher wishes to illustrate the relative numbers of the human race embraced in the three great forms of religion—paganism, Mohammedanism and Christianity—a circle or square representing the entire population of the world, divided into three parts which will illustrate the relative proportions and

THE WORLD'S CORN CROP

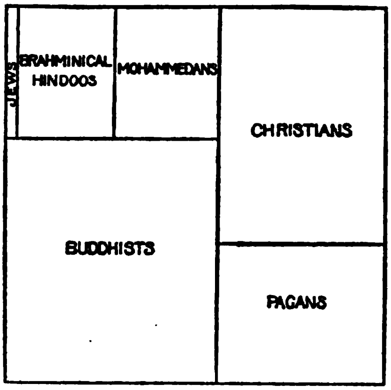


THE WORLD'S COTTON CROP

having each division of a different color, brings out the fact very clearly.

15. Pictures. Present methods of illustrating books and periodicals make pictures so numerous and so inexpensive that every school can have its picture cabinet for illustrating the geography and history lessons. It is also to the advantage of the teacher to have a collection of her own which she can use to supplement the school collection.

(a) SELECTION. Photographs, engravings and plain and colored halftones are the styles of pictures most easily obtainable. Of all these, the plain halftone used in illustrating the best magazines and textbooks is the most valuable, because it is the most easily obtained and the least expensive. Hundreds of such pictures can be clipped from periodicals without any expense. Photographs are very desirable, and when one can afford them a limited number adds much to the interest and value of the collection. Views with the stereoscope are especially useful, because the instrument enables the pupils to obtain a good idea of the relief forms presented in the pictures. This feature can also be brought out, though not as well, by using a good magnifying glass, such as a reading glass, with ordinary halftones.

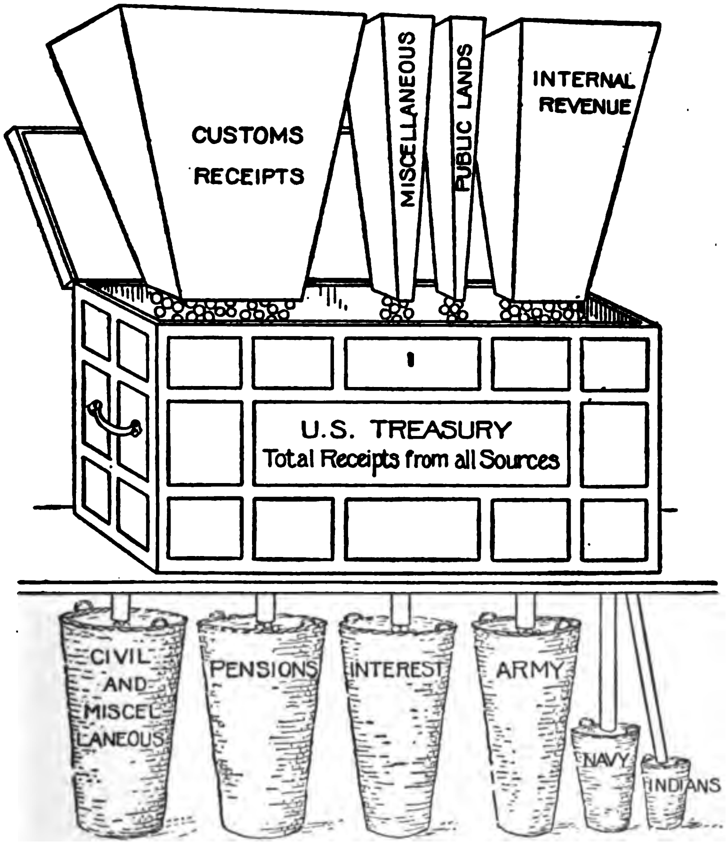


GREAT RELIGIONS OF THE WORLD

Pictures should be selected with great care. Those designed for the lower grades should be simple and contain only strong general features. Complex views should not be used in these grades. The collection should contain such a variety of views as will represent coast lines, strong physiographic features and the activities connected with great industries. Both pupils and teachers should aid in making

the school collection. Colored views should be selected with caution. Cheap colored pictures are not true to life, and should in all cases be avoided. In general, plain halftones are much more satisfactory than cheap colored views, and the bulk of the collection will naturally consist of these and of photographs.

(b) MOUNTING AND FILING. Pictures should be mounted



RECEIPTS AND EXPENDITURES OF THE UNITED STATES GOVERNMENT

in some manner that will preserve them. One of the most convenient devices is to use heavy manila paper, cutting it

so that there will be a margin of at least one inch around the picture. The title, if not printed on the picture, should be written under it, and whatever description needs to accompany the view should be written upon the back of the mount.

An inexpensive and convenient device for filing consists of large envelopes. The pictures can be arranged by countries or continents, as desired, and the title of the group may be written upon the back of the envelope. This arrangement enables one to find at once whatever pictures the cabinet contains bearing upon the subject in hand. With proper instructions as to care in handling and replacing the pictures in the envelopes from which they are taken, pupils should be allowed free access to the picture cabinet.

(c) USES. Some teachers secure much better results from the study of pictures than others, because they know better how to use them. Failures arise from unwise selection, from lack on the part of the teacher to study the picture and decide the points to which the attention of the class should be called, and from presenting too many pictures at a time. If you do not have a stereoscope or other lens through which the pictures can be viewed, the stereoscopic effect can be produced by closing one eye, and with the other looking at the picture through the hand folded into a tube like a telescope. This simple device is often very helpful. The following suggestions will be found helpful in the use of pictures:

(1) See that the pictures selected illustrate the point in hand; if they do not, do not use them. Here a word of caution in regard to illustrations in the text-book is necessary. The desire of authors and publishers to introduce a large number of pictures for the purpose of making these works appear attractive sometimes leads them to use such as do not illustrate the text-matter, and when you discover that the pictures and the text do not agree, you should follow one of two plans; either ignore the picture entirely or give an oral description which will enable the class to use it intelligently.

(2) Call attention to what you wish the pupils to see. This is especially necessary with the younger classes and in all classes with pictures that contain a large number of objects; otherwise some of the pupils will give attention to one feature of the picture and others to another, and possibly some will fail to see the points which you wish observed.

(3) Question the pupils so as to have them bring out in their observation the points desired. The answers to these questions will enable you to discover any errors in observation or judgment and to correct these at the time.

(4) When the class is large and there are not enough copies of the picture to enable all to study it at the same time, hold the picture before the class and call attention to the points to which you wish to direct their attention. This saves time and waste of effort.

(5) Finish the exercise by having the pupils describe the picture from memory. This oral description can be followed by a written one, if desirable. (See Volume One, pages 278 and 285, Sections 3 and 6.)

(6) Use the same picture as many times as may be necessary to secure the desired result.

(7) Be sure that you connect the work of the picture with the text-matter in the lesson, provided the picture is used for the purpose of illustrating the text.

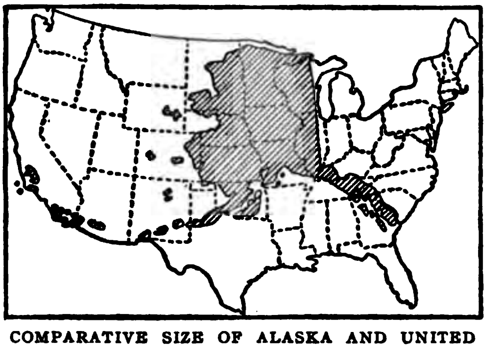
SKETCH OF A MOUNTAIN GORGE

(d) SKETCHES. Simple blackboard sketches are often of great advantage in making descriptions plain. A defile in the mountains, a railway cut, the form of an iceberg, the

relative height of mountains, the kind of dwellings people construct in different parts of the world and many other facts can be vividly brought out in this way, if the teacher is skilful with the use of the crayon. These sketches should not be elaborate but should consist of only a few lines which will bring out the features desired. Any teacher wishing suggestions for blackboard illustrations will find *Chalk Illustrations*, by Eliza H. Morton, very helpful.

16. The Historical Element. The relation of geography to history is discussed on pages 157-158, Section 4. At this point we wish to speak of the historical element in geography. We must not lose sight of the interest which people take in places because of events that transpired in them. Gettysburg is an unpretentious village among the hills of Pennsylvania, but the great battle fought there has given it a world-wide celebrity that brings to it thousands of visitors every year. Concord, Lexington, Plymouth, Quebec, Waterloo and scores of other places have like interest. The historical incidents should be brought out at the time the class studies the locality in which the places are situated.

The development of any region depends upon its geographic conditions, and in the study of the industries and civilization of a locality we cannot overlook the fact that they depend upon geographic conditions. Western Pennsylvania is devoted to the manufacture of iron and steel because the locality abounds in coal and iron ore; the Mississippi Basin is the richest agricultural region of the world because of alluvial soil; the flood plains of the great rivers of the Old World, the Po, the Nile and the Ganges,



COMPARATIVE SIZE OF ALASKA AND UNITED STATES

have been the homes of powerful nations since the dawn of history. These facts should be brought out with the older pupils.

The history of names is also of interest to children. This line of work can be developed by asking the class to answer such questions as, For whom was Lake Champlain named, and why? Why do the names of mountains, rivers and lakes in New England differ so widely from those in New York? In the New England states we find such names as Androscoggin, Saco, Connecticut, Katahdin, Winnepesaukee, while in New York we find Mohawk, Seneca, Cayuga, Oneida and many others differing widely from the names in the first group. The answer to this question will show the class that the names of the mountains and rivers in these parts of our country were given them by the Indians and that the original names have been retained. This leads to the further knowledge of the fact that one family of Indians occupied the New England states and another family having a different language occupied the state of New York. Another interesting exercise in names consists in having the children who are studying the United States discover how the different states received their names. Again, why are there so many French names in the Mississippi Valley, and why are there so many Spanish names in California, New Mexico and Arizona?

A word of caution may be necessary at this point. In considering the historical element in geography just sufficient emphasis should be given to this element to lend interest to the geography lessons. It should not take precedence in this study as in case of the study of history. Were the class studying the history of the southwestern portion of the United States, they would be interested in tracing out the expeditions of the early Spanish explorers and the founding of the various missions in that part of our country, but in studying the geography of the region the only attention that should be given to these facts is that which shows the pupils that the names found there were given by the early

Spanish settlers. Again, the geography of our great cities, Boston, New York, Philadelphia, Chicago, Saint Louis, for instance, would be incomplete without reference to their beginning and growth. In nearly every phase of political geography we find a historical element which should not be ignored.

17. The Literary Element. For more than three-quarters of a century the writings of Sir Walter Scott have been drawing people of other lands to visit the scenes of events that never transpired and the homes and haunts of people that never lived. The geography of Scotland should not be passed over without calling attention to the localities immortalized by this great writer. In a like manner the geography of Nova Scotia requires a reference to *Evangeline*, that of New England to *Snow-Bound* and to some of Thoreau's remarkable descriptions. The geography of Cambridge, Mass., is incomplete without reference to the Old Elm and Craigie House, and *Hiawatha* has done for an otherwise insignificant waterfall near Minneapolis what the *Lady of the Lake* did for the Trosachs in Scotland. Many of our poets have woven into their songs the scenic beauty of our own and other lands. The literary element in geography should not be neglected, therefore, since it adds interest and meaning to the subject. (See Volume One, pages 277-278, Section 2.)

18. Advanced Geography. Advanced geography is the title usually applied to the text-book following the elementary geography. The work done before this book is reached should have prepared the pupils for its use. The teacher, however, must make a thorough study of the book, to get a conception of its scope and plan. Some advanced geographies still in use begin with general definitions and follow these with lessons on mathematical geography. The plan of such a book should not be followed. If the previous work has been done properly the pupils will have learned the definitions of most of the terms that they will use, and they should learn others as the work leads to them. Most

of the abstract generalizations called for in lessons on mathematical geography are altogether too difficult for pupils of this age. With such a book the better plan is to begin with the study of a continent or country which the work in the grade below most naturally leads up to. However, since at least one-half the time spent upon the advanced geography should be devoted to the United States, it is usually wise to begin work with our own country, unless the work in the grade below strongly points to some other plan.

In the main, the plan of the book for the study of continents and countries should be followed; otherwise, the pupils will become confused between the plan presented by the teacher and that found in the text. Type studies will enable the class to avoid repetition and are also valuable for supplementing the lessons in the book. Most advanced geographies contain too much, and the teacher should select the most important portions and place emphasis upon them. The great countries, such as the United States, Great Britain, France, Germany, Russia, China and Japan, should receive special attention. Unimportant countries, such as Spain, Portugal and Persia, can be passed over lightly, and if time is short, some of them may be omitted. Recent developments, such as the progress of civilization in Africa, the construction of the Panama Canal, and the introduction of a national legislature into Russia, should receive attention in connection with the study of the countries with which they are associated.

The amount of supplementary work which can be done with the class in advanced geography is limited only by the capacity of the class, the time they can devote to the subject and the sources from which material can be obtained. Classes having access to numerous reference works and to good libraries can of course accomplish much more than those deprived of these aids. Good newspapers and periodicals are always available, and there is seldom an issue of such a publication that does not contain one or more articles which can be used with the work in geography. Among

those worthy of special mention, because of the direct bearing of many of their articles upon geography, are the *National Geographic Magazine*, published by the National Geographic Society, Washington, D. C., *The World's Work*, and the *American Review of Reviews*, both of New York City.

19. Commercial Geography. Before they leave the elementary school, pupils should acquire some knowledge of the sources of supply, the processes of manufacture, the methods of distribution, and the cost of our most common commodities. Whenever possible, commercial geography should constitute a part of the work of the highest grammar grade of the graded schools and of the oldest pupils in the rural schools. The introduction of this subject adds interest to the work and helps to retain the older boys in the rural schools. (See *Coal*, Volume One, page 288; also, *The Study of Corn*, pages 6-20 of this volume.

If commercial geography cannot be taken up as a regular study, much can be accomplished by studying great types of industries from an industrial and commercial point of view. Such types as wheat, corn, cotton, coal, petroleum, iron and steel, the manufacture of textiles, banking and exchange, transportation, the influence which such inventions as the steamboat, the locomotive, the telegraph, and the various applications of electricity have had upon the leading industries of the world and the influence of commerce upon civilization are illustrations of topics that can be taken up successfully on the plan of type studies. For outlines for these type studies, see the lessons on *Coal* and *Corn*, above mentioned.

By whatever plan commercial geography is pursued, the pupils should be led to realize the geographical conditions upon which industry and commerce depend. Pupils should also understand how value is added to material by the expenditure of labor upon it, both in manufacture and in transportation, and how inventions and the division of labor have reduced the cost of many commodities; and they should also learn something of the elementary principles governing

credit and exchange. Such knowledge is of the greatest practical value. In no other way can pupils be led so easily to realize the interdependence of different parts of the world.

"One of the greatest lessons of all is to discover how every part of the earth is now made to contribute to the needs and welfare of every other part, and to see with what expenditure of energy, capital and ingenuity the aggressive races of Europe have built canals, opened ocean highways and continental railroad lines. The iced meats of Australia soon find their way to London, and refrigerator fruitcars cross the continent of North America in a few days. These topics lead us close to the present trade rivalry of the great powers for the commerce of the world, and to the question how the prices of staple products are fixed by the world market."[1]

20. Comparisons. Comparative studies bring out the points of resemblance and difference between similar features in different localities or unlike features in approximate localities. A comparison of the Andes with the Himalayas, of the Nile with the Mississippi, or of Eastern with Western civilization affords good illustration of this kind of studies. The teacher can lead the pupils to make such comparisons by asking them to answer such questions as, Why were the Japanese successful in the late war with Russia? Why is the population of the Mississippi basin more evenly distributed than that of the basin of the Nile? How do methods of farming in the central portion of the United States compare with those in China.

21. Aids. The teacher's aids in geography fall under the four heads, material illustrating industries, clippings, pictures, and books.

(a) MATERIAL. By interesting pupils and patrons, the teacher in almost any school can collect a small cabinet of specimens useful in illustrating geography. The specimens should be of products not common in the locality. All cabinets need specimens of raw material produced in foreign lands, such as cocoons of the silkworm, hemp fiber and the fiber of cocoanut. Specimens which illustrate the various processes in the manufacture of common articles, as cotton

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[1] McMurry: *Special Method in Geography.*

and woolen cloth, boots and shoes, wheat flour, the latter showing the various stages of the wheat from the time it enters the mill until the finished product is prepared, are also of great value.

By arranging to exchange specimens with schools in different parts of the country, valuable additions can often be made to the geography cabinet. It is also well occasionally to buy specimens which cannot be obtained at home or by exchange. Unfortunately, there are no dealers who make a specialty of handling this material for school purposes.

(b) CLIPPINGS. Newspapers and periodicals contain many articles valuable for the geography class. Teacher and pupils should be constantly on the watch for such articles. Clippings should be filed in accordance with directions given on page 141-142, Section 15. They should always be at the disposal of the pupils, under the restriction that the clippings be handled with care and always placed back in the envelope from which they were taken, when the pupils are through using them. In connection with the clippings there should also be kept a card index of the articles in magazines which cannot be cut, and of chapters in books which bear upon the subject. This index increases in value from year to year.

(c) PICTURES. The selection, mounting, filing and use of pictures have already been described in Section 15.

(d) BOOKS. The following list of books is divided into two classes, those suitable for the teacher and those that can be used by both teacher and pupils.

(1) *Books for Teachers.* Only such works are mentioned as can be procured at nominal or moderate prices:

Special Method in Geography. C. A. McMurry. 217 pages. Macmillan Company. This is one of the most helpful works that the teacher can obtain. It gives full directions for the selection of material for the study of types.

New Basis of Geography. Redway. 225 pages. Macmillan Company. This work is valuable for showing the foundation upon which geography under the present methods of teaching rests, and it should form a part of the equipment of every teacher of the subject.

The Teaching of Geography. Geikie. 202 pages. Macmillan Company. A work containing many valuable directions and suggestions.

Man and his Work. Herbertson. 136 pages. Adam and Charles Black, London. Though an English publication, this work can be obtained of most dealers in the United States. It is of especial value in showing the influence of geographic conditions upon human activities.

Methods and Aids in Geography. King. 518 pages. Lee & Shepard. This work contains many valuable suggestions and devices, though its statistical matter is decidedly out of date.

How to Study Geography. Parker. 400 pages. Appleton & Company. This is one of the International series and gives a more scientific treatment of the methods of studying and teaching geography than any other work included in the list. Some portions of it are somewhat difficult, but they will repay the study necessary to enable the teacher to understand them.

Manual of Geography. Redway. 175 pages.

By the same author: *The Reproduction of Geographical Forms*. 84 pages. D. C. Heath & Company. The *Manual* renders the latest discoveries in geography valuable for the use of teachers and contains chapters on clay and sand modeling and map drawing. The book has for its purpose the grouping of the various forms and outlines of relief into types more difficult than teachers of elementary schools usually care to undertake.

Lessons in New Geography. Trotter. 182 pages. D. C. Heath & Company. Contains many valuable hints and topics with suggestions for some of the most recent methods.

International Geography. Mill. 1088 pages. Appleton & Company. A comprehensive treatise of the countries of the earth, each being treated by an author specially qualified to write upon the country which he described. For its price it is the most useful reference work in geography in existence.

Physical Geography. Davis. 428 pages. Ginn & Company. An excellent and quite comprehensive elementary text-book upon this subject. Contains many valuable illustrations, and the text is easily undertsood.

Introduction to Physical Geography. Gilbert and Brigham. 380 pages. Appleton & Company. An excellent elementary work for both teachers and pupils.

Chalk Illustrations. Morton. 200 pages. A. Flanagan Company. This is a suggestive handbook for making free-hand sketches. It contains a large number of illustrations and full directions for making blackboard drawings.

The New Practical Reference Library. 5 volumes. The Dixon-Hanson Company. This is an excellent reference work for both

teacher and pupils. Simple in style, of recent date, printed in clear type, beautifully illustrated, and sold at a price which brings it within reach of everyone, this work forms a valuable accession to the teacher's library.

(2) *Books for Teachers and Pupils.* The various series of geographical readers put out by the different publishing houses, as well as such books on travel as the Boy Traveler series, the Zigzag Journeys series and Family Flights series, are especially interesting to pupils, and they contain many geographical facts presented more completely than it is possible to do in a text-book. The more of such books the pupils have access to, the more complete understanding of geographical subjects they will be able to obtain. Every school should have an atlas, a globe, and an encyclopedia that can be read and understood by the pupils. In addition to the above works, the teacher will find the *Statesman's Year Book* and almanacs containing statistics, such as that published by the New York *World*, the New York *Tribune*, Chicago *Daily News* and other great journals, valuable for furnishing statistical matter that is up to date.

WORK BY GRADES

22. Fourth Grade. The following outline is suggested for the work of the fourth year:

(1) Collect results of previous study.
(2) Local physiography; hills, valleys, mountains, prairies and rivers. (Section 7.)
(3) Springs, brooks, lakes, ponds, swamps.
(4) Trade and occupations of the immediate locality.
(5) Maps. (Section 13.)
(6) Excursions and imaginary journeys. (Section 12.)
(7) The world as a whole; form, size, day and night. (Section 8.)
(8) Natural divisions of land and water.
(9) Continents and oceans.
(10) Location and extent of North America and its leading physiographic features, or study of the state. (Section 10.)
(11) Topics relating to history stories. (Pages 162 and 165-166, Sections 12, 13 and 15.)
(12) Local government. (Pages 186-187, Section 33.)

23. Fifth Grade. The work of the fourth grade should be continued as follows:

(1) Review work of the previous year.

(2) North America. Chief physiographic features; soil, climate, productions, people, political divisions.

(3) Smaller type studies of the United States, such as a coal mine, Niagara Falls, cotton raising. (Section 9.)

(4) The United States as a whole. Great divisions of surface, river systems, Great Lakes, climate, groups of states, chief products, chief manufactures, ten largest cities, chief railway and water routes.

(5) Study of the state reviewed and extended.

24. Sixth Grade. Most of the time of this grade should be devoted to the other countries of North and South America. Follow the plan for continents and countries given in the previous section:

(1) Other countries of North America. Same plan as for the United States.

(2) South America. Same plan as for North America.

(3) West Indies.

(4) Topics suggested by history lessons. (Pages 162 and 165, Sections 12-13.)

(5) Study of maps, making the work more minute than the previous year.

25. Seventh Grade. The work of this grade should consist of the study of Europe and Asia, and a special study of the United States; also of the chief facts of climate and mathematical geography:

(1) Eurasia. (Section 22, Topic 10.)

(2) Europe.

(3) Leading countries of Europe. In connection with each country locate its colonial possessions.

(4) Less important countries of Europe.

(5) Asia.

(6) Leading countries of Asia.

(7) East Indies.

(8) Africa.

(9) Australia.

(10) Races of men.

(11) Great commercial routes of the world.

(12) Special study of the United States, following the plan of text-book. (Section 16 and 17.)

26. Eighth Grade. The work of the eighth grade should consist of:

(1) The general study of Asia and Africa, with special attention to recent developments in those grand divisions.

(2) Great empires of the world, as wholes, including colonial possessions, method of government, resources and commercial advantages of each.

(3) Different forms of government.

(4) Distribution of heat, isothermal lines.

(5) Winds. Rainfall. (Pages 61-66, Sections 38-44.)

(6) The ocean, tides and currents.

(7) Distribution of natural resources of the world, forests, mineral, fuels and metals.

(8) Location of great agricultural regions. Compare with each other.

(9) Astronomical zones.

(10) Change of seasons, giving attention only to the chief causes.

(11) Commercial geography by type studies of great industries, with special view to their commercial importance.

27. Ninth Grade. The work of the ninth grade will consist of the study of commercial geography, or of physical geography from the text-book. The plan of the book should be followed.

TEST QUESTIONS

1. Show how geography differs from botany in its treatment of cotton and allied subjects, and from meteorology in its treatment of climate.

2. Show how you would lead a sixth grade class to see why London is the greatest commercial and financial center of the world.

3. Give a brief description of the surface of the locality in which your schoolhouse is situated and show to what extent you can make use of lessons on this region in teaching the natural divisions of land and water to a fourth grade class.

4. Make a freehand outline map of the state in which you live, placing in it the principal rivers and mountain ranges, the chief cities and the leading trunk lines of rail-

way. Do this without a map of the state before you. How many minutes did you spend upon the drawing?

5. Show why and in what particulars oral instruction in geography requires of the teacher more extensive and more thorough preparation than does the use of the text-book.

6. What is the relative importance of the study of maps and the study of the text, for pupils using the advanced geography? Give full reasons for your answer.

7. Explain by the use of a globe your method for teaching the cause of day and night to a fourth grade class.

8. What places in North America have been made famous by the writings of our great authors?

9. Give your opinion of what constitutes a good text-book in elementary geography. What books come nearest to your ideal?

10. Give a plan for teaching commercial geography in the eighth grade, when no text-book is used.

LESSON SIXTEEN

HISTORY AND CIVIL GOVERNMENT

HISTORY

INTRODUCTION

1. What History Is. History is too commonly considered to be a mere record of national events, chiefly military and political, arranged in chronological order. Such a view of history is inadequate. "History is the science of the development of men in their activity as social beings," says Bernheim; and the great English historian, Froude, says, "History is a voice forever sounding across the centuries the laws of right and wrong." We should consider history, then, as the record of man's development, a record that in its scope includes all the activities of the race.

2. Divisions of History. Historical writings are classified in various ways, as ancient history, medieval history and modern history, when the periods are emphasized; church history, political history and military history, when a special phase of activity is emphasized; or as German history, French history, English history and American history, when the national feature forms the basis of classification.

3. Relation of Divisions. Whatever the divisions that may occur in historical writings, we should remember that history as a whole is a unit, that these divisions form parts of that unit and are therefore all more or less closely related to each other. The fact of this relation is of special importance when we come to consider the position of American history as one of the parts of this great whole. We cannot consider the history of the United States as wholly distinct from that of European countries, especially Germany, France and England. Without the recognition of this relation, the history of the United States cannot be given such a setting

as will enable pupils to understand the origin and meaning of American institutions.

4. Relation to Other Subjects. As we have seen by its scope, history is related to all other branches of knowledge. Every phase of human activity has its history, and human progress in any given locality is largely dependent upon environment. Nevertheless, some subjects are much more closely identified with history than others. Of this number, geography, art and literature are the most important.

(a) GEOGRAPHY. Countries, climate and natural resources are the most important external agencies in man's development; therefore, a knowledge of these conditions is necessary to the understanding of the history of the people of any locality.

Columbus made his celebrated voyage, not to discover a new world but to find a new path to the Far East. The magnitude of his undertaking can be realized only when we understand the conditions under which the expedition was conceived. To Europeans the known world consisted of their own continent, a portion of western Asia, northern Africa and a few islands in the adjoining coast waters of these continents. The theory that the earth was round, which Columbus held, was not generally believed at that time. He hoped that by sailing westward he would reach Cipango (Japan) in a voyage of 2,500 or 3,000 miles; but the shores he sought were 12,000 miles distant. By taking a course along the parallels which on the maps of the time crossed the southern part of Japan, he entered the American Mediterranean and discovered the West Indies. Unless the pupil understands these conditions, and also realizes the width of the Atlantic Ocean where the expedition crossed, the first voyage of Columbus means but very little. Likewise, the exploration and settlement of the United States can be understood only when the pupil is acquainted with the physiography of the country.

The dependence of history upon geographic conditions is too often overlooked in teaching both history and geography.

Teachers should remember that these subjects are inseparable.

(b) ART. In architecture, sculpture and painting we see what peoples of the past have accomplished along material lines, and a study of such works throws much light upon the progress of civilization. Hence, graphic representations are of great value in the study and teaching of history. The present methods of illustration have made it possible for teachers to obtain useful collections of pictures for the work in history, and every teacher should have such a collection in her possession.

(c) LITERATURE. History constitutes an important branch of literature, and the works of the most celebrated historians are considered as classic. Such are the writings of Xenophon, Herodotus, Tacitus and others, among ancient writers; of Froude and Gibbon, in England; Guizot, in France; Mommsen, in Germany; and Bancroft, Prescott, Lothrop and Parkman, in America. But in addition to historical writings, proper, there is a great body of literature that is founded upon history. Poets of all lands have immortalized minor events by their vivid narration. Tennyson's *Charge of the Light Brigade*, Longfellow's *Paul Revere's Ride* and Lowell's *Under the Old Elm* are good illustrations of such incidents. The orations of statesmen and others on public occasions, debates in legislative assemblies and the resolutions and platforms of political parties also constitute a class of literature of great historic value. The teacher should be familiar at least with the literature of that portion of history which she teaches and use it for adding interest and clearness to the subject.

PURPOSES OF TEACHING HISTORY

5. Introductory. Every teacher should have in mind certain well-defined ends to be reached in the teaching of history, and they should be included in a plan of instruction extending from the intermediate grades through the high school. Doubtless no teacher will take classes over the entire course, but that portion of it which comes directly

under her charge will be more intelligently directed if she has a clear conception of the entire plan.

In graded schools and in many states in the ungraded schools, this plan is found in the course of study. Under whatever conditions the teacher is placed, she should become familiar with the course of study in history before beginning her work. Whatever may be the plan she is to follow, it does not excuse her from attempting to secure certain definite results which should always be attained through the teaching of the subject.

6. Imparting Information. The first purpose in teaching history is to impart information. A knowledge of the leading facts of the history of our own country, at least, is essential to everyone who would be considered intelligent, and whenever possible this knowledge should be extended to include the leading facts of the world's history. Public speakers frequently cite historic incidents to substantiate an argument or illustrate a point; newspapers and periodicals are constantly using historical facts, and unless the reader is acquainted with history he does not understand these allusions.

7. Mental Development. Another important purpose in teaching history is to assist the development of certain mental powers, particularly memory, imagination, judgment and the emotions. During the early part of the school period the memory and imagination are especially active. If properly presented at this time, the leading facts of our history will be indelibly impressed upon the minds of the pupils. (See Volume One, pages 78-81, Sections 7-10.)

Perhaps no other subject of the elementary and secondary schools is better suited to the training of the reasoning powers than history. In mathematics the reasoning is exact—only one conclusion can be reached; in literature the conclusion is found by the study of the text; but in history the conclusion is invariably problematical; it depends upon the decision of the man or body of men most vitally concerned in the final result. To reach tenable conclusions

in problems of history the pupil must bring all his knowledge, experience and judgment to bear upon them. He must consider both sides of the question and weigh the arguments before he can reach a decision. The training received through the solution of such problems fits the pupil to grasp practical affairs. (See Volume One, pages 84-86, Sections 15-17.)

8. Patriotism. Through their study of history, pupils should be brought into sympathy with our institutions and acquire a love for them. Doubtless patriotism is the focal point around which the teaching of history most frequently centers, but the teacher should have a clear conception of what true patriotism is, before beginning to develop this sentiment in her pupils.

Of the sort of patriotism which consists in throwing hats in air and shouting for the flag; in glorying in our material resources for the wealth they represent; in attributing to the United States all that is good and noble while denying the same qualities to other nations; in manifesting a warlike spirit on the slightest pretext; in "falling back on the cry 'Our country, right or wrong,'" we already have a superabundance. Unfortunately, this variety of patriotism is frequently stimulated through the study of history in our schools.

True patriotism is that which is based upon the love of our institutions because of what they have cost, and what they represent; the trials and struggles not only of our forefathers in America, but of the nations from which they sprang. Such patriotism is based on a love for humanity that extends far beyond the boundaries of our own country.

The citizen actuated by true patriotism is honest in his dealings with all men, gives his share of time and his influence to secure good men for public office, regards his vote as a sacred trust, has due respect for our laws and obeys them, does not shirk public duty, and if elected to office administers the affairs of his office in the interests of the

people. Of this kind of patriotism the country is in great need, and it is this that the schools should inculcate.

9. Use of Books. The study of history calls for extensive reading, and through it pupils can acquire facility in the use of books, a facility which they should gain before they leave school. History also should influence the pupil's reading, and lead him to a love for historic literature.

10. Development of Character. "Historical knowledge is moral knowledge." Through the study of history the pupil lives in imagination with the good and great of the past. He learns by what qualities they succeeded, how they extolled virtue and condemned vice, and that because of their heroic struggles for truth and liberty we enjoy the privileges under which we live. Consciously or unconsciously, he is influenced by the lives of these men, and thereby his character is strengthened.

Another way in which the study of history should assist in the development of character is in fostering a desire to search for the truth and a willingness to abide by it when found. The pupil who has a high regard for truth will be truthful and fair-minded in all things. This is another way of saying what we have emphasized regarding patriotism (Section 8). The good citizen is a man of good character.

ORAL INSTRUCTION

11. Selection of Material. The material for history stories for the early stages of the work should be selected with relation to the following points:

First, it should be founded upon historic fact. Many so-called history stories are only fiction, and the use of such material is harmful in the extreme.

Second, the selections should be from American history and those portions of European history, especially the history of England, which are vitally associated with American institutions. Pupils below the high school cannot devote enough time to the subject to enable them to become familiar with more than the leading facts of the history of our own

country; American history also affords concrete examples of all stages of progress, from primitive life, as shown by the Indians and other primitive peoples, to life in the most highly-organized society.

Third, the material should easily come within the pupil's comprehension. Biographies of pioneers, such as Boone, Tonty and Roger Williams; the lives of bible characters, as Moses, Joseph, Samson, and others; biographies of Old World heroes, real and mythical, as Ulysses, Achilles, Alexander the Great, Alfred the Great and Charlemagne; and stories of primitive life, such as those about the Indians, the French in the Mississippi Valley, and the early New England colonists, are more suitable to the first year's work than many which are frequently selected. To illustrate, because of the geographical conditions involved, the biographies of Columbus, Magellan and the Cabots are more difficult to understand than are those of Sevier and George Rogers Clark; and because of the complex relations connected with them, the biographies of such men as Grant, Lee and McKinley can be used to better advantage during the fifth year. Since biography is particularly interesting to children, it should be selected for the earliest work. In due time, biography can be followed by history stories and stories of invention.

Where the time for this study is limited, it is wise to confine the lessons to American history; but, when time will permit, the pupils should be given an idea of the ancient Greeks and Romans, and should also learn something of early life in England.

12. Method. The true teacher will have her own method, but in its preparation she will secure valuable assistance from the experience and suggestions of those who have had great success in teaching history. The method must conform to the laws of mental development, and contain such devices as will gain and hold the interest of the pupils. (See Volume One, pages 75 and 94, Sections 4 and 29.) It should include the following points:

(a) Selecting the Story. The first step in the teacher's preparation for the beginning work in history is the selection of material. We have already indicated in a general way by what the teacher should be guided in the choice of this. However, the range of material is so broad that the teacher must scan the field carefully. Unfortunately, books of history stories suitable for children of this age are not numerous, and those obtainable are altogether too brief for the teacher's purpose. She is then under the necessity of resorting to larger works, and the danger is that she will make selections that are too difficult.

Children are always interested in people, and especially in other children; therefore, if these first stories can be about the boyhood of men who became famous, the pupils' interest will be aroused at once. Stories of the boyhood of Washington, Lincoln and Columbus are good illustrations of what can be used to advantage in American history. The use of these stories does not violate the principle of simplicity, notwithstanding the fact that during later life these men were associated with events which were complex. The stories are to end before this period is reached.

(b) Organizing the Material. The second step is organizing the material for the lessons, or arranging the plan of presentation. This step is important, because upon it depends to a large degree the success of the work. A proper organization of the material requires on the part of the teacher a much more extended knowledge of the subject than she can impart to the pupils. From her abundance of knowledge she should select facts and incidents best suited to the class, and in addition to her knowledge of the subject she must have a large sympathy for the children.

First in the plan of organization is the setting. This should include all the geographical and other information necessary to enable the pupils to obtain a clear picture of the surroundings amid which the person lived. It should also contain a vivid description of the person, his dress and

such personal peculiarities as will help the pupils to gain as complete a picture of him as possible.

After the setting, the leading facts in the biography should be arranged in their logical order, then the minor points related to each of the leading facts should be selected and arranged in the order in which they are to be presented. This will enable the children to follow the narrative without difficulty, and to recall the points in their logical order. For a teacher to begin a story and then go back and start again in another way not only destroys the pupils' interest in the lesson but also confuses their thought. The story should be thought out carefully, then told in a simple, straightforward manner, without break and without repetition.

(c) TELLING THE STORY. Experience has shown beyond doubt that the most satisfactory results in history at this period are secured through an oral presentation of the subject. At this point the success of the teacher depends upon her ability to tell stories. While some have greater natural aptitude for story telling than others, by training and practice nearly all teachers can become successful in this method of presentation. Each of the leading facts in the story is a topic around which cluster all the related facts. These leading facts form a series of topics which are linked together by their logical relations, and each topic thus selected forms a unit which should be taken up and completed before proceeding with the next. The completion of the story, then, may require several recitations.

Present the story in a clear and animated manner. Use simple language. Make your descriptions real, and so vivid that the children can see the pictures that you present; appeal to the pupils' fund of knowledge and to their experience. Use graphic illustrations, such as maps and outlines on the blackboard, and, whenever possible, pictures that will assist the pupils in forming correct ideas of the subject. When outlines are used, they should be constructed as the story proceeds, and should consist of words, phrases or short

sentences, as may be most helpful to the pupils. (See Volume One, page 123, Section 18.)

Caution. Avoid side issues, and do not extend the units or the story as a whole to an unnecessary length. Only such details as are necessary to enable the pupils to gain correct ideas should be given, and all irrelevant matter should be strictly excluded. One of the most important requisites is that a teacher shall know when to say no more.

(d) REPRODUCTION BY THE PUPILS. After the presentation of the story or of any topic in it, the teacher should call upon the pupils to reproduce what has been told them. The recitation should be by the pupils. A word of caution or approval now and then by the teacher is all that should be necessary. The story should be reproduced by as many pupils as the period will permit. Errors and omissions will appear in the reproductions; these should be corrected by the pupils or by the teacher. Errors in language can be corrected by quietly asking the pupil to substitute the right form, without disturbing his train of thought. The aim should be to secure a connected reproduction of the essential facts, in their proper relation and in good language.

An outline on the board will help the pupils to follow the order of the narrative. The pupils should copy the outlines neatly in ink into notebooks provided for the purpose. (See Volume One, pages 277-278, Section 2.)

13. Transition from Biography to History Stories. Stories should not be repeated at frequent intervals; in order to keep the interest alive, it is well, after a number of biographies have been given, to take up a story whose narrative is concerned chiefly with events. If this can be local, as a story describing the first settlements in the town or state, it is all the more interesting to the children. If material for a story of the locality cannot be obtained, accounts of the early settlements in the colonies, exploring expeditions, such as those of Lewis and Clark and Fremont, or George Rogers Clark's campaign to conquer the northwest, are suit-

able. All of these and many others should be used during the fourth and fifth years.

The pupils should also be made acquainted with the great inventions which have revolutionized the industries, and therefore many of the customs, of the world. Gutenberg and the printing press, Watt and the steam engine, Whitney and the cotton gin, Fulton and the steamboat, Stephenson and the locomotive, Hargreaves and the spinning frame, Cartwright and the power loom, Morse and the telegraph, Bell and the telephone, and other inventors and inventions should receive attention.

14. Relation to Reading. By the time the pupils have completed the third reader, they should be able to read and enjoy the simple history stories such as Andrews' *Ten Boys*, McMurry's *Pioneers on Land and Sea* and *Pioneers of the Mississippi Valley*, Catherwood's *Heroes of the Middle West* and Sedgwick's *Samuel de Champlain*. It is an advantage if some of the stories in the first books which the children read by themselves have previously been told to them.

The historical element in the reading lessons should also receive attention. Many selections such as *The Landing of the Pilgrim Fathers*, the *Skeleton in Armor*, the *Norsemen* and *Grandmother's Story of the Battle of Bunker Hill* must have the proper historical setting before they can be read with intelligence. Selections of this character can also be used effectively to embellish and add interest to the history lessons. This line of work should so influence the child's reading that before the end of the fifth year he will have acquired a love for historical literature.

15. Extending the Circle. Up to the seventh grade the pupil has been learning about people and events, without giving any particular attention to their sequence or interdependence. He should now begin the study of events in their chronological order. He should have his attention called to the relation which events sustain to each other and should be led to see that each succeeding event is the direct outgrowth of those which have preceded it.

The periods from the beginning of the settlement of the colonies through the French and Indian War are the most suitable for study at this time. As in the previous work, the material selected should deal only with the leading facts. The settlement, mode of life, industries, government and religion of the four great colonies, Virginia, Massachusetts, Pennsylvania and New York, should be studied. In studying the settlement of these colonies, the pupils should learn something of the classes of people in the mother country from which the settlers came and their reasons for seeking homes in America. The colonies should be compared in respect to the influence of geographic conditions, customs of the people in each, their industries, religious beliefs, form of government and provisions for education. This line of study is most successful when centered around the lives of the leading characters, such as Winthrop, Penn, Bacon and Yeardley.

Certain units should receive special treatment. Among these are Bacon's Rebellion, the establishment of representative government, the Iroquois Confederacy, and Braddock's and Wolfe's campaigns. A preparation for the study of the French and Indian War should consist of a review which will enable the pupils to see the relation of events leading up to it. The influence of this struggle upon the future history of the country should be emphasized. These matters are of much greater importance than a detailed study of the military campaigns. (See Section 23.)

During the work the pupils should be required to obtain most of the information for themselves from books, and specific directions for use of the books at the disposal of the pupils should in any case be given by the teacher. (See Volume One, page 128, Section 22.) Under no conditions should condensed histories which contain a mere statement of facts and dates be used.

16. Written Work. History affords an abundance of material for written exercises, and placing in writing what they have learned fixes it in the pupils' minds. When the

The Homes of the Pilgrims.

When the Pilgrims came to our country, they found it very cold. There were no houses for them to live in, so the men began to build some. They chopped down trees and made log houses and covered the roofs with bark.

They did not have any glass, so they used oiled paper for windows.

In each house was a big fireplace.

The men would put big logs into it and the fire would last a long time. The women did all the cooking over this fire. On each side of the fireplace were fastened long, iron arms called cranes. The kettles were hung on these and were swung over the fire.

AN ILLUSTRATED WRITTEN EXERCISE

pupils have completed the study of a unit they should give a written account of it. Neatness and accuracy in spelling, capitalization and language should be insisted upon in all these exercises. Much interest is added to this feature of the work by occasionally having the pupils illustrate their papers. The illustration on the opposite page shows what can be done without too great expenditure of time. (See Volume One, pages 123-124, Sections 18-19.)

USE OF THE TEXT-BOOK

17. Work of the Teacher. If the work already outlined in this lesson has been done, the pupils are prepared for the use of the text-book. Before the book is introduced, however, certain duties devolve upon the teacher. The first is to become thoroughly acquainted with the book to be used. This acquaintance should embrace a knowledge of what the book contains, of its weak as well as its strong points, and a comprehension of the plan and purpose of the author. The second duty is to form a proper conception of the book. The text-book is not a fetich to be worshiped, neither is it a mere mass of printed matter to be regarded lightly. The true conception lies between these extremes. The method of using the book will be determined to a considerable extent by the teacher's conception of it; therefore, her estimate should be formed with due deliberation. No text-book should be followed blindly.

18. Assignment of Lessons. Pupils should be started right at the beginning, otherwise they are liable to form a dislike for the subject. Therefore, the teacher should give careful attention to the assignment of the lesson. Fully one-half of the difficulties of the recitation are removed by a proper assignment. Time spent here is time saved in the next recitation. (See Volume One, pages 112-114, Section 9.) Questions that provoke thought are of great value, for they guide the pupils to a method of study. If the lesson is studied with a view to answering these questions, the pupils will be far less liable to memorize the text, and when

they once acquire this method of study they will think of many questions for themselves. Again, if these questions are given when the lesson is assigned, the pupils have opportunity to find suitable answers before coming to the recitation, and they are not confused by being confronted with questions which are too difficult to be answered without deliberation.

19. The Recitation. The assignment of the lesson determines in a large measure the character of the recitation. When guided in his study by questions that he is to answer, the pupil is not liable to recite the words of the text. If he does, he should be stopped immediately. The chief purpose of the recitation is to ascertain whether or not the pupils understand what they are talking about, not to hear what they have memorized from the text. At this stage of the history work it is injurious to the pupil to memorize facts without understanding them. (See Volume One, page 115, Section 11; also pages 248-252, same volume, Sections 10-11.)

The chief purpose of the text-book is that of a guide in the study of the subject, and it should be used in such a manner as to render the greatest assistance. Whenever opening the book in class will settle a disputed point or enable the teacher to direct the pupils in their study, the book should be used. But it should not be used in class for the purpose of assisting the pupils in perfecting their recitation.

20. Outlines. Outlines are occasionally valuable for showing the relation of events, for grouping together the causes which have contributed to a given result, for giving a graphic representation of periods, and for reviews. The outline should be constructed by the pupils and teacher together as the study proceeds, and should be one of the results obtained from the study of the lesson, instead of a guide to that study. An outline should be simple, clear, and so arranged as to bring out strongly the feature that it is intended to represent. The plan of construction will vary

with the purpose of the design. The following illustrations show forms that can be used with profit:

OUTLINE SUMMARY

CIVIL WAR

YEAR	EVENTS IN THE EAST	EVENTS IN THE WEST AND IN THE CENTER	POLITICAL AND FOREIGN EVENTS
1860			Nov. Election of Lincoln Dec. Secession.
1861	Apr. 13. Fall of Fort Sumter. Apr. 15. Call for troops. July 21. Bull Run.	Aug. 10. Wilson's Creek.	Feb. 4. Organization of Confederacy. Peace Congress. Nov. 8. *Trent* affair.
1862	Mar. 9. *Monitor* and *Merrimac*. Mar. 11. Peninsular Campaign begun.	Jan. 19. Mill Spring. Feb. 6–16. Forts Henry and Donelson captured.	
		Apr. 6–7. Shiloh. Apr. 8. Island No. 10. Apr. 25. New Orleans. Apr. 30. Corinth.	Mar. Legal Tender Act.
	Apr., May. Jackson in Shenandoah Valley. May 31. Fair Oaks. June 26. Seven Days' Battle begun. Aug. 30. Second Battle of Bull Run.		July. Internal Taxation Act.
	Sept. 14. South Mountain. Sept. 16, 17. Antietam.	Sept.-Oct. Bragg's invasion of Kentucky. Oct. 3. Corinth. Oct. 8. Perryville.	Sept. 22. Emancipation Proclamation announced.
	Dec. 13. Fredericksburg.	Dec. 31. Murfreesboro.	

The following plan groups together the chief events in the formation of the Union:

STEPS LEADING TO FORMATION OF THE UNION

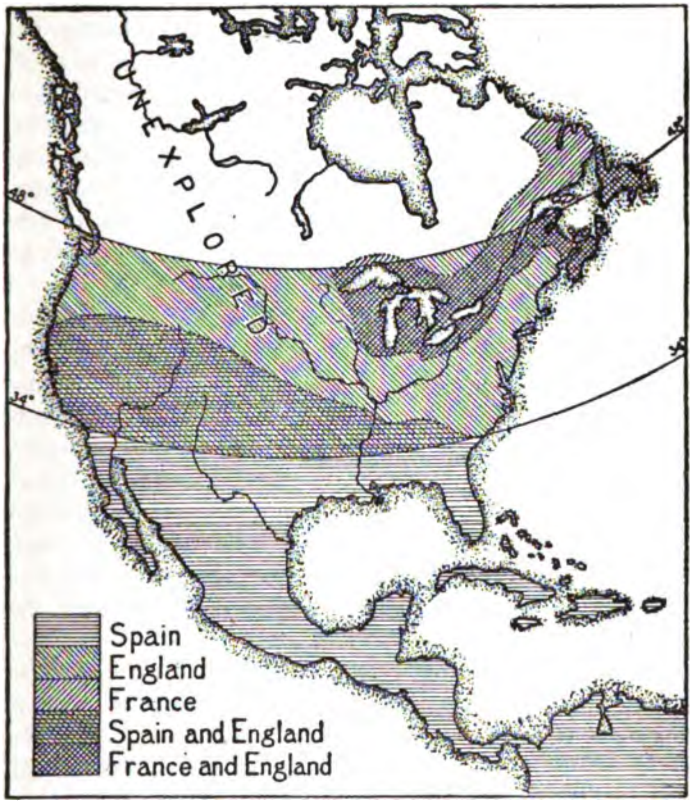
1	Union of New England Colonies	1643
2	Albany Convention	1754
3	Stamp Act Congress	1765
4	Non-Importation Agreements	1769
5	Committees of Correspondence	1772–1773
6	First Continental Congress	1774
7	Second Continental Congress	1775–1781
8	Articles of Confederation	1781–1789
9	The Constitution	1789

21. Dates. The subject of dates gives many teachers more trouble than its importance justifies. It is necessary that certain focal dates which mark turning points in history should be remembered. Good examples of such dates are the discovery of America, 1492; the settlement of Jamestown, 1607; the settlement of Plymouth, 1620; the battle of Quebec, 1759; the Stamp Act Congress, 1765; the election of Lincoln, 1860, and Lee's surrender, 1865. In most instances it is more important to remember the order in which events occur than the exact year in which they occurred. If the topical method of recitation is followed, the pupils are led to look for causes and effects, and it is not difficult for them to remember events in the order of their occurrence.

It is usually wise to have the pupils keep a list of dates to be remembered, adding to it the dates that they reach in the course of this study. Their list should not be long—five previous to the organization of the government under the Constitution, twenty-two from the inauguration of the government to the election of Lincoln, and sixteen from the election of Lincoln to the present time—in all, sixty-three dates for the entire period of American history. If the pupils memorize these dates and comprehend the significance of the events which they mark, they have a much better grasp of history than they will obtain from memorizing several times this number without any thought of their meaning.

22. The Use of Maps. Geographic conditions lie at the foundation of the great results of history, and it is often as important to know *where* an event happened as to know that it happened. From the beginning of his work in history, the pupil should become accustomed to the use of maps, and during the study of his history lesson the map should be consulted whenever it can give assistance. If the teacher would realize that the map is as important in the study of history as in the study of geography, much of the vagueness and unreality in the minds of the pupils would

be dispelled. Good text-books contain both outline maps and complete colored maps, but in addition to these the pupils should construct many simple outline maps for themselves, or procure outline maps and fill them in as the study



TERRITORIAL CLAIMS OF ENGLAND, SPAIN AND FRANCE IN AMERICA IN 1600

progresses. The latter is often the better plan, since it furnishes accurate outlines, and the pupils can devote their entire time to filling in the work gone over. Nearly all of the schoolbook publishers offer outline maps at a nominal cost. The accompanying map shows how these can be used

effectively. Both teacher and pupils should also sketch maps on the blackboard whenever such sketches will aid the recitation. Wall maps should be used during the recitation, and often each pupil should be required to point out the places which he names.

23. Military Events. Many text-books devote too much space to wars and military campaigns, to the exclusion of subjects of greater importance. The causes leading to and the results following a war are usually of more importance and should receive greater attention than the military campaigns connected with it. Yet enough attention should be given the military movements to enable the pupils to obtain a clear conception of what the moving of a great army involves and also some ideas of the horrors of war. The best way to do this is to select a campaign in some war and make it a type study. Wolfe's campaign against Quebec, Burgoyne's campaign, the siege of Vicksburg and the campaign leading to the battle of Gettysburg afford good material for this treatment. Not more than two should be selected. (See Section 27.)

The cause of most wars is economic. The French and Indian War, so far as the American colonies were concerned, was a struggle for the control of the resources of the Mississippi Valley and the Newfoundland fisheries, and the economic conditions under which the contending forces lived in America contributed largely towards determining the result of the contest. The causes of the Revolution were economic; those of the Civil War, social and economic. The pupils should be led to see the importance of economic conditions and to realize something of the extent to which they underlie the great struggles in the life of the nation.

24. Civil Institutions. Under this head are included government, education, religious and social customs, and financial measures. These are of much greater importance than the military events, and should receive careful consideration. The development of these institutions should be studied in each period as the work progresses. In the study

of colonial life the pupils should have obtained a clear idea of the different forms of government in the New England and Southern colonies, but the difference between royal, charter and proprietary government can be studied more profitably with the causes leading to the Revolution, because the pupils are more mature and can better understand the essential points of difference. In a similar manner the Articles of Confederation should be studied in connection with the political events of the Revolution, and the pupils should obtain a general idea of the form of government under them; their points of weakness can better be left until the study of the movements for a constitution are taken up. Educational and religious movements and the great financial measures should be treated in a similar manner.

It is very important that the pupils trace our institutions from their beginning, and that they be led to realize the self-denials and struggles through which they were secured. The development of sympathy which such a line of study will produce will have greater influence than any other phase of history in the formation of that civic patriotism which we have already described. (See Section 8.)

25. Industries. The influence of our industries on the life of the nation is too often overlooked. When the children first learn about the great industries they are too young to comprehend their effect upon society; during their work in the seventh and eighth grades, the development of such industries as transportation; the manufacture of textiles; the growing of wheat, corn and cotton; dairying; lumbering, and numerous other lines of work should receive special attention. In the study of industries, special stress should be placed upon their influence on society. Pupils should be led to see how the introduction of the factory system and the construction of railways and canals were the primary causes leading to the growth of cities, and that as cities became manufacturing centers they also became commercial centers. City and country life should be compared and the advantages and disadvantages of each should be pointed

out. Were this faithfully done in the rural schools, the glamour with which young people of the country surround city life would largely disappear.

Industries can be studied to best advantage on the plan given for type studies. (See Section 27.) The older pupils should give some consideration to the growth of corporations, and should be given some insight into the formation of stock companies and the manipulation of stocks. This leads to the relation of economics to industries, and we see at once that we cannot discuss the one without the other.

Topics of this nature are of especial interest to the older boys, and serve to lead them into new lines of investigation. They also show the practical side of history more clearly than do its military and political struggles. This phase of history is so closely related to the history of inventions and discoveries that one cannot be dwelt upon to any length without treating of the other. For instance, the history of the power loom and the cotton gin cannot be given without showing their relation to the development of the manufacture of cotton goods in the United States. (See Volume One, pages 287-289, Section 8.)

26. The Study of Types. In the preceding Section we referred to type studies as affording good means of studying some of the great industries, and they are of special value in saving time and repetition as well as for giving the pupils connected ideas of a subject. The study of one railway system like the New York Central Railroad, the construction of one canal like the Erie Canal, the development of a single industry like the boot and shoe industry, and of a single campaign, give the pupils fundamental ideas that pertain to all subjects of the class to which the type belongs. The New York Central Railroad is typical of all railroads, and with a thorough study of that the other great railway systems can be passed with only such attention as is necessary to show their relation to the question of transportation.

Type studies should be selected with a view to the work to which they will apply, and the work required of them

should be of such nature as to come easily within the capacity of the pupils, and also within their facilities for acquiring the information called for. Within these limitations type studies constitute some of the most valuable work that can be done.

27. A Type Study. As an illustration of a plan for study, the following sketch of Burgoyne's campaign is given:

(a) GENERAL CONDITIONS. At the close of the first year of the war for independence, the British troops occupied only New York and Newport. Sir Guy Carleton had attempted to invade the New England colonies and New York by the way of Lake Champlain, but retired before accomplishing any permanent results. The British naturally were somewhat chagrined at their failure and determined to establish a line of military posts extending from the Saint Lawrence River to New York by the way of Lake Champlain and the Hudson River.

Ever since the settlement of North America these valleys had been the natural highway north and south through that part of the country, and both Abercrombie and Amherst had led large armies through them during the French and Indian War. On either side of the Hudson and of Lake Champlain the country is hilly, and in many places even mountainous. At the time of the Revolution most of this region was covered with heavy forests. There were scarcely any settlements in the vicinity, and forest paths were the only roads.

(b) PLAN OF CAMPAIGN. The British minister of war saw the importance of gaining possession of this highway. If he could establish a series of posts between Canada and New York he could thus cut off the New England states from the others, and he hoped by this means to subdue the different states, section by section. In order to accomplish this, the most formidable campaign projected during the Revolutionary War was organized. The invading forces were under the command of General Burgoyne, an officer of skill and experience. He was sent to Canada with over

4,000 British regulars and 3,000 Hessians, all of whom were veteran troops under the highest degree of discipline. Joined to these were about 300 Canadians and 500 Indians, most of the latter belonging to the Five Nations. This army of about 8,000 men was to ascend Lake Champlain, thence cross over the height of land between the valley of the lake and the Hudson River and descend the river until they formed a junction with British forces, which at the time the campaign was planned were in New York under the command of Sir William Howe.

Another detachment of troops under the command of Saint Leger was sent to the vicinity of Oswego and was to march down the Mohawk Valley and capture Fort Stanwix, an American outpost that commanded that portion of the frontier.

Opposed to these movements was a force of about 3,000 Americans in the fort at Ticonderoga, under the command of General Saint Clair, and another force of about equal numbers at Fort Edward, on the Hudson, under the command of General Schuyler.

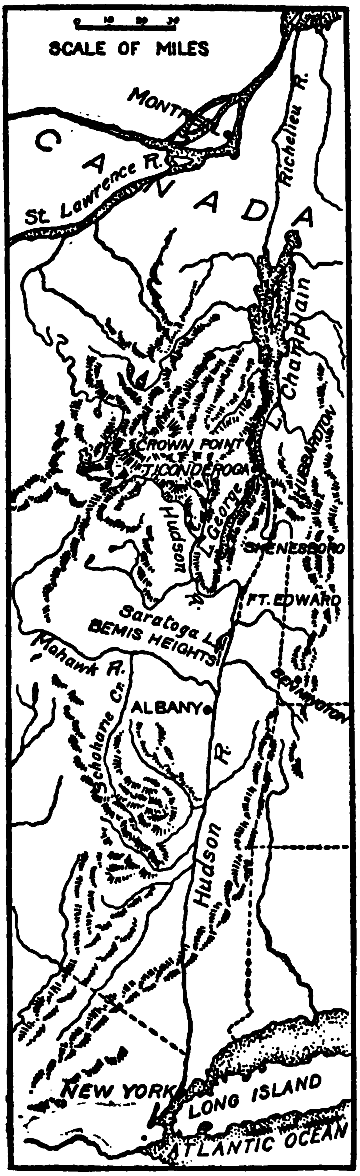
(c) BURGOYNE'S INVASION. Burgoyne moved his army up the Richelieu River and Lake Champlain in boats. Near Ticonderoga was an eminence that overlooked the fort. Thinking this point was of no importance, the Americans had failed to occupy it. The British at once placed cannon upon this height, and against these cannon the walls of the fort afforded the Americans no protection; therefore, Saint Clair evacuated Ticonderoga during the night, crossed the lake and started towards Fort Edward to join Schuyler.

The rear guard of Americans was overtaken at Hubbardton by a detachment of British under General Frazer. At first the Americans were successful, but the British were reenforced and the American commander, seeing that his troops were to be overwhelmed by superior numbers, ordered them to break ranks and disappear in the forest, with instructions to meet at Manchester at future date. While the battle of Hubbardton was a victory for the British,

the stand taken by the Americans delayed the pursuit of Saint Clair's army so long that he was able to join Schuyler at Fort Edward without further loss.

Up to this point Burgoyne's progress had been unobstructed, and he thought that the ease with which he captured Ticonderoga was to characterize all his movements until he joined forces with Howe. But the British commander, as well as the British ministry, had failed to take into consideration some very important conditions. Among these were the condition of the country and the consequent difficulties attending the movement of a large army with its supplies and artillery. They had also mistaken the attitude of the inhabitants of this region.

While the country was sparsely settled, nevertheless it contained hundreds of sturdy farmers and woodsmen who knew every mile of the forest and also knew how to use the ax and the crowbar —tools to which Burgoyne's soldiers were entire strangers. From the time he left Ticonderoga until he crossed the



MAP OF BURGOYNE'S CAMPAIGN

Hudson River, Burgoyne was fighting an unseen foe. He found his roads obstructed by huge trees that were felled across them; wherever bridges had been built they were demolished, and often the repairs which his soldiers made during the day were destroyed at night. His progress was very slow; between Hubbardton and Fort Edward it averaged about a mile a day. His supplies were getting short. His Indian allies, because of restrictions placed upon them, became disgusted and withdrew. He had been obliged to leave about a third of his forces to guard Fort Ticonderoga; consequently, the number of his troops was constantly diminishing. On the other hand, the Americans from far and near were flocking to General Schuyler's standard. The employing of the Indians had greatly incensed the people of all that region, and regardless of their former allegiance they banded together to suppress an invader who would bring with him a horde of savages who in battle could not be restrained, but indiscriminately massacred men, women and children.

(d) BENNINGTON. The Americans had gathered a quantity of provisions and military supplies at Bennington. Burgoyne, hoping to replenish his supplies, sent a detachment of troops under Colonel Baum to capture these stores. Through American scouts all of his movements were known, and when the British forces reached Bennington they found themselves confronted by from two to three times their number of American yeomen under the command of General John Stark. A heavy rain delayed the battle for twenty-four hours, thus giving the British an opportunity to entrench themselves upon a hill. However, the ignorance of the British commander was greatly to the advantage of the American forces. By moving in small squads of five or six, they passed entirely around the British works and assembled so as to attack the enemy from both front and rear at the same time. This attack the British were unable to withstand, because the Americans were skilful riflemen and seldom missed their mark. In a short time Baum and

his forces were either killed or captured. A second detachment of British troops under Colonel Riedesel arrived upon the field at just about the time that a second detachment of Americans under Colonel Seth Warner reached Bennington, and another engagement followed, in which the Americans were equally successful. The battle of Bennington was a serious disaster to the British commander.

(e) SAINT LEGER'S CAMPAIGN. Shortly after the battle of Bennington Saint Leger's force encountered the Americans under General Herkimer at Oriskany, and one of the bloodiest battles of the war ensued. Herkimer was mortally wounded, but the British and Indians were finally driven from the field. They proceeded toward Fort Stanwix and were again attacked and driven back. While Saint Leger was recuperating his forces at this point, Benedict Arnold with 1,200 men was dispatched by General Schuyler to Fort Stanwix to assist the Americans in repelling the British. Arnold captured a company of British scouts, among whom was a half-witted fellow whom he threatened to put to death unless he would frighten Saint Leger's troops so that they would immediately retreat to Canada. To this proposition the doomed man readily agreed. Arnold caused the man's coat to be shot full of bullet holes, then sent him back to Saint Leger, accompanied by two friendly Indians. On reaching the headquarters of the British commander he explained that Burgoyne's forces had been utterly defeated and captured, and that the whole American army was coming up the Mohawk Valley. This report was confirmed by the Indian guides. When Saint Leger asked him concerning the number of American troops, the man pointed to the leaves of the trees and said that they were so numerous that they could not be counted. Arnold's ruse succeeded far better than he expected. The British were so thoroughly frightened that they beat a precipitate retreat, and nothing more was heard of Saint Leger or his troops during the Revolution.

(f) Burgoyne's Surrender. Burgoyne's army was now placed in a critical position. Without supplies, with communications cut off and the American troops increasing in number, his only hope was in cutting his way through to General Howe's forces on the Hudson or retreating speedily to Canada. Since quite a large body of Americans had gathered in his rear, it was doubtful whether the retreat could be accomplished, and he decided to push on and join Howe. After crossing the Hudson he was confronted by the American forces at Bemis Heights and again at Freeman's Farm. In each encounter the British were disastrously defeated, and the only course left to their gallant commander was to capitulate, which he did on October 17, 1777. Thus fell into the hands of the Americans the largest and best-equipped army that England sent to the colonies during the Revolution, together with all their arms and munitions of war. The effect of this battle was to give the American cause increased prestige in Europe and thereby to secure the assistance of France, without which possibly the Revolutionary War could not have been won. For these reasons the surrender of Burgoyne is considered to be the turning point in the war.

(g) Suggestions. This sketch contains only the thread of the narrative. To this the teacher should add such facts and incidents as will awaken the interest of the pupils and also enable them to gain some conception of the difficulties attending the movements of a great army through a new country. Benedict Arnold, Daniel Morgan, Philip Schuyler, Horatio Gates and John Stark are such prominent characters in the campaign that the study should include their biographies, briefly summarized. The influence of geographic conditions is also so important that it demands special consideration.

If this campaign is studied according to the plan given, the other campaigns of the war can be passed over lightly, in most instances merely noting their location, origin and result.

28. History and Literature. Much of our early literature is devoted to the discussion of political questions, and consists of speeches and public discussions. Some of the best of these have been preserved, and extracts from them can often be used in connection with the history lessons. Good illustrations are some of the speeches of Samuel Adams and Patrick Henry, among Americans, and Burke's Speech on Conciliation, on the British side. Our poets have also done much towards preserving the memory of important historic events, and such poems as *Independence Bell*, *The Courtship of Miles Standish*, *Evangeline*, and the *Boston Tea Party* should be drawn upon to illuminate the incidents to which they refer. Short poems can be studied in connection with the lesson, but the longer ones should be used as supplementary reading, unless they form a regular part of the work in literature.

29. Current History. Pupils should understand that history is being made every day, and that present history is related to past as effect to cause. Occasionally, teachers refrain from teaching recent history because of the complex problems bound up in it, but these events are often so similar to those that have happened that they offer excellent illustrations of the points under discussion; when used for such a purpose, recent events become of great interest to the class and are well understood.

30. Reviews. This subject is discussed in Volume One, page 106, Section 3.

CIVIL GOVERNMENT

31. Correlation of Civil Government and History. In the preceding Sections reference has frequently been made to correlation of history topics, with special reference now and then to the importance of emphasizing the development of our civil institutions. If this work has been done, by the time the pupils reach the constitutional convention in the course of their study of history they are prepared to take up and discuss the leading features of the Constitution. A

study of the convention should bring out the conditions which made a change in the national government necessary, the nature of and reasons for the three great compromises in the Constitution, and the departments of the government established. If time permits, a brief outline of the functions of each of these departments should also be given. The leading points of difference between the Constitution and the Articles of Confederation can be shown by the following plan:

THE CONSTITUTION	THE ARTICLES OF CONFEDERATION
1. The constitution provides a national government based more or less on the will of the people.	1. The articles pledged a league of the states.
2. Representation in the lower house of congress is based upon the population of the state. Each state has two senators. Each member of Congress has one vote.	2. Congress consisted of only one branch; each state, whatever its number of delegates, had only one vote.
3. The supreme court has jurisdiction over all disputes between states.	3. Congress decided disputes between states.
4. No state is allowed to coin and issue money.	4. Congress shared with the states the power to coin and issue money.
5. The power to regulate commerce and raise revenue is vested in the national government.	5. The power to regulate commerce and raise revenue was wholly under the control of the states.
6. Congress has power to declare war and to raise and maintain an army and navy. If necessary it can draft men for this purpose.	6. Congress could declare war but the power to raise troops was within the control of the states.
7. Congress now has power to levy and collect taxes.	7. Congress could not collect taxes from the states.
8. Congress can authorize and execute all laws necessary for carrying into execution the powers conferred upon it.	8. Congress could not compel the observance of laws.
9. Congress has power to guarantee the payment of loans contracted by the United States.	9. The payment of borrowed money could not be guaranteed.
10. The constitution has been found adequate to every emergency that has arisen.	10. "Congress could declare everything, but could do nothing."

32. Powers of the National Government. The powers of the national government are best understood when they are brought out by concrete illustrations. Hamilton's financial measures required the levying of duties and an excise tax. Whence did the government obtain the power to levy taxes? The answer to the question is obtained from the Constitution, Article I, Section 8. The answer opens the way for the discussion of direct and indirect taxes, and the difference between these methods of taxation should be explained and illustrated. When the class reaches Jay's Treaty, the first after the organization of the government, the treaty-making power of the government should be explained. The election of 1800 leads to the study of the method of electing the President and also to the study of Amendment XII; and the purchase of Louisiana affords an excellent illustration of what is implied in the terms "loose construction" and "close construction." Each event that relates to a power of the government not already studied should be treated in a similar manner when it is reached. (See Volume One, pages 290-293, Section 9.)

Doubtless the Judiciary department is the most difficult to understand, but its leading features can be grasped readily, and the study of details should be left for the more advanced work of the high school. The following outline presents a comprehensive view of the United States courts, and will be found helpful. The teacher should prepare a similar outline of the courts of the state:

UNITED STATES COURTS

TITLE	ORGANIZATION	JURISDICTION *
Supreme Court	A chief justice, salary, $13,000; eight associates, salary, $12,500.	This court has original jurisdiction in all cases relating to ambassadors and other public ministers and consuls; and those to which a state is a party. It has appellate jurisdiction in all cases originating in the inferior courts, save such as congress by law shall except. Appeals may be made to it, and writs of error lie to it, from the district and circuit courts, from the courts of appeals, and from the supreme courts of the District of Columbia and the territories.

TITLE	ORGANIZATION	JURISDICTION*
Circuit Courts of Appeals.	Nine, each with a justice of the supreme court, and two circuit judges.	Appeals from circuit, district, and territorial courts.
Circuit Courts.	Nine circuits, each with two to four circuit judges, twenty-nine in all; salary, $7,000.	Its jurisdiction embraces an extensive control of criminal cases, which is for the most part concurrent with that of the district courts. The circuit courts have jurisdiction over all civil suits involving the construction of federal law where the amount involved is at least $2,000. Where the United States is the plaintiff the money limit does not apply. The same jurisdiction is given also to the circuit courts whether or not a federal law is involved, providing the suit is between states, or between citizens of the United States and foreign states or citizens thereof.
District Courts.	Ninety-two districts, each with a district judge; salary, $6,000.	Largely over cases connected with the revenue laws, admiralty matters, suits against consuls, cases arising under the postal laws, and criminal prosecutions for violations of federal laws.
Court of Claims.	A chief justice, salary, $6,500; and four associates, salary, $6,000.	Over money claims of individuals against the government.
Court Private Land Claims.	A chief justice, $5,000, and four associates, $5,000.	Decides conflicting claims of title to certain public lands.
Court Appeals District Columbia.	A chief justice, $6,500, and two associates, $6,000.	Hears appeals from the supreme court of the District of Columbia.
Supreme Ct. District Columbia.	A chief justice, $5,000, and four associates, $5,000.	Resembles in jurisdiction other United States district courts.
Territorial Courts.	Judges appointed for four years.	Resembles United States districts courts.
Admiralty Courts, Commissioners' Courts, and Courts-martial.		

*The supreme court has both original and appellate jurisdiction; the circuit courts of appeals, and the court of appeals for the District of Columbia, have only appellate jurisdiction; the other courts only original jurisdiction.

33. Local Government. Local government includes the government of the school district, the township, the county and the state. It is better adapted to lessons for the younger pupils, because the pupils can find concrete illustrations of its workings at home. By the time the pupils are old enough to take up work of this nature they know that certain men engage the teacher and look after other interests of the

school, that others look after the roads and streets, and that taxes are paid to the official authorized to receive them.

By using these and other common functions of government, the teacher can give many valuable lessons which will convey to the pupils a fair understanding of the powers and duties of local authorities and set them to thinking about their own relation to the laws and their enforcement. The details of elections should not be attempted at this time. But beginning with the school district, the lessons should be extended to include the township, village or city, as the case may be, and the county. Pupils prepared to take up the systematic study of history with a text-book can also understand the organization and workings of the state government. (See page 123, Section 10.) The average citizen comes in contact with the state government more than a score of times where his interest touches the national government once. The basis of state government is older than the national government, which is patterned after the government of some of the original states. In organization, the state government and the national government are also very much alike. Each has a legislative, an executive and a judicial department; the state legislative assemblies are composed of two branches, resembling in their organization and duties the Senate and House of Representatives of Congress, and the state courts, grading from the local justice or municipal court up to the Supreme Court, are arranged on a plan similar to that of the United States courts.

If pupils do this work during the first year that they use the text-book in history, they have a good foundation for the study of the national government as the work of the following year leads to it.

34. Importance. Time can seldom be found for special classes in civil government in the grammar grades, but it is very necessary that the pupils obtain some idea of the organization and working of the government under which they live, because the majority of them never attend high school. Therefore, it is the duty of the teacher to do this

work in connection with the history lessons. If necessary, some of the details of our history should be omitted to make room for these lessons, which are of far greater value than such topics as accounts of the campaigns of the War of 1812, the Seminole War and discussions on the tariff which pupils cannot understand.

35. Use of the Text-Book. The study of civil government by the use of the text-book is usually taken up in the high school, and the line of work that may be attempted depends to such a considerable extent upon the year in which the subject occurs in the course of study that no outline of plan is here attempted. Pupils in the fourth year can enter much more fully into details than pupils in the first year, and the teacher must be guided by the maturity of the class, the time that can be devoted to this branch, and, to some extent, by the sources upon which the pupils can draw for information. Whatever the scope of work, emphasis should be placed upon two features—obtaining from it a clear understanding of the great underlying principles of our government and discovering concrete illustrations of the various points discussed during the study.

36. Aids. Every teacher of history should make a collection of material which will be useful for additional information and for illustration. This material naturally arranges itself into three groups—books, clippings and objects.

(a) Books. The following list of books is arranged in groups, those of each group having special bearing upon the subject named.

Books of Methods:

Special Method in History. C. A. McMurry. 291 pages. The Macmillan Company. This is an excellent work. Its style is clear and simple, and it is especially helpful in directing the work of the intermediate grades.

Topical Studies in American History. Allen. 93 pages. The Macmillan Company. A dependable work in assisting the teacher in the use of the topical method in history. Marginal notes cite numerous publications that are valuable for source material.

Method in History. Mace. 311 pages. Ginn & Company. This

book is somewhat philosophical and a little difficult to read, but it contains much good material, and any teacher will be strengthened by its study.

How to Study and Teach History. Hinsdale. 365 pages. American Book Company. An elaborate work containing a great deal of information. The last chapter is followed by a syllabus which gives a clear and concise analysis of the book.

Methods of Teaching History. G. Stanley Hall, editor. 391 pages. D. C. Heath & Company. This is a collection of essays by celebrated teachers of history. It is designed for high school teachers, but a number of the chapters are of special worth to the teacher in the elementary schools.

Guide to American History. Channing and Hart. 471 pages. Ginn & Company. This is a work of unusual value in directing the teacher along lines that the older pupils should follow and in pointing out material suitable for supplementary work.

Course of Study in History and Literature. Emily J. Rice. 187 pages. A. Flanagan Company. It shows the intimate relation between history and literature, and contains an excellent list of topics for use in the different grades.

Reference Works:

Source Book of American History. Hart. 408 pages. The Macmillan Company. This is a collection of material reprinted from original sources. The marginal notes indicate the source from which the extracts are taken, and the quaint style and old-fashioned spelling of considerable of the matter make the book one of great interest both to teachers and pupils.

Geographic Influences in American History. Brigham. 366 pages. Ginn & Company. This work shows in a clear and interesting manner the influence which the geographic conditions of the country have had upon its development from the earliest settlement to the present time. It is beautifully illustrated with relief maps and halftones.

Historical Geography of the United States. MacCoun. 46 pages. Silver, Burdett & Company. This little manual contains 43 maps illustrating the boundaries of the United States at different periods, also the idea the ancients had of the world and of the maps of the world at the time of the discovery of America. The text gives a brief description of the maps.

High School History of the United States. Johnston. 612 pages. Henry Holt & Company.

Students' History of the United States. Channing. 615 pages. The Macmillan Company. Every teacher needs one or more textbooks that are more complete than the one used by the school. This book and the one named above are especially helpful for supple-

mentary work, and more assistance in obtaining additional information can be secured from either one of them than by the expenditure of the same amount of money in any other way.

Supplementary Books:

New Practical Reference Library. 5 volumes. The Dixon-Hanson Company. For description see page 151, Section 21, *Books for Teachers.*

Epochs in American History; The Colonies. Thwaites, 301 pages; *Formation of the Union,* Hart, 278 pages; *Division and Re-union,* Wilson, 322 pages. Longmans, Green & Co. These volumes are written in a clear, forceful style and are excellent authority on the periods which they cover. Each volume contains a number of reliable colored maps.

Industrial History of the United States. Coman. Gives an account of the development of our industries from the colonial period to the present time.

Border Wars of New England; The Making of New England; The Making of the Ohio Valley States; The Making of Virginia and the Middle West. Samuel A. Drake. Charles Scribner's Sons. The style in which these volumes are written makes them very attractive to young people. The descriptions are vivid, and the narrations are in accord with fact.

Colonial Dames and Goodwives. Alice Morse Earl. Houghton, Mifflin & Co.

Costumes of Colonial Times; Customs and Fashions in Old New England; The Sabbath in Puritan New England; Colonial Days in Old New York. Alice Morse Earl. Charles Scribner's Sons. These volumes are unusually interesting to pupils, and they give a vivid description of the periods of which they treat. No other work within reach of the pupils covers this ground in so satisfactory a manner. The books are especially valuable for school libraries.

Old Virginia and Her Neighbors (2 vols.); *The Discovery of America* (2 vols.); *The American Revolution* (2 vols.); *The Beginnings of New England; The Critical Period in American History; The Dutch and Quaker Colonies in America.* John Fiske. Houghton, Mifflin & Co. For clearness of diction, interesting style and unquestionable authority, the historical works of John Fiske are not excelled by those of any other American writer. They are a constant source of inspiration to the teacher.

Pioneers of France in the New World; Jesuits in America in the Seventeenth Century; LaSalle and the Discovery of the Great West; The Old Regime in Canada; Count Frontenac and New France under Louis XIV; A Half-Century of Conflict (2 vols.); *Montcalm and Wolfe* (2 vols.); *The Conspiracy of Pontiac* (2 vols.). Parkman. Little,

Brown & Co. Parkman's works are the most complete and authentic of those which treat of French history in America. They are pleasing and interesting in style and constitute one of the most valuable sources for history stories for the intermediate grades.

The following sets of books are recommended for school libraries. They can be obtained in single volumes or in sets, as desired:

The two series of books, *American Statesmen* and *American Commonwealths*, both published by Houghton, Mifflin & Co., are valuable for pupils in the grammar grades. The list is too long for insertion here.

American History Told by Contemporaries. Vol. I: *Era of Colonization;* Vol. II: *Building of the Nation;* Vol. III: *National Expansion;* Vol. IV: *Welding of the Nation*. Edited by A. B. Hart. Macmillan Company.

Civil Government:

Government in State and Nation. James and Sanford. 374 pages. Charles Scribner's Sons. This is one of the most complete and valuable text-books on civil government. It gives adequate treatment to state and city governments and also to the civil service, in addition to a complete outline and discussion of the national government.

Civil Government in the United States. John Fiske. Houghton, Mifflin & Co. This work shows the evolution of our government from early institutions, also gives a clear insight into the difference between the governments in the different colonies, and shows how the present state governments have been formed from those of colonial times.

The American Government. Hinsdale. American Book Company. This comprehensive work contains much valuable matter that can be used in supplementing the work of the text-book.

(b) CLIPPINGS. Current magazines and newspapers frequently contain articles which are helpful in teaching history. The teacher should be on the watch for these and place them in such form that they can readily be found. In order that she may do this, she should have a carefully-arranged scrap cabinet. This can be prepared at little expense, by using large envelopes in which to keep the clippings. Each envelope should be devoted to a topic or a period, as the Revolutionary War, Slavery, Reconstruction, and the subject should be written across the envelope in

large letters; the title of each clipping should be written below, on the back of the envelope. This arrangement is very convenient and with proper caution about placing clippings back in the envelopes from which they are taken the scrap cabinet can safely be placed at the disposal of the pupils. Pictures illustrating different periods should be collected and filed in the same manner. A card index of magazine articles, books and chapters of books should also be kept. (See page 140, Section 15.)

(c) OBJECTS. Oftentimes a small museum of historical objects can be collected for the school. Some pupils may have in their homes objects which have been handed down through the family for several generations, and may date back as far as the Revolutionary period. These the families are usually willing to loan, provided they are assured that the articles will be properly cared for. The collection of such material adds interest to the work, gives it a reality and also enables the pupils to contribute something from their own stock of material.

WORK BY GRADES

37. Explanatory. The work suggested in the following sections pertains entirely to American history. Equally valuable and instructive lessons in ancient history and English history can be given, provided time for these can be found, but it is so seldom that this can be done in the average school that it is not thought wise to complicate the outline by suggesting exercises on these subjects. Where European history can be taken, schools are usually provided with a course of study in which an outline of the work is given.

38. Fourth Grade. The history work in the fourth grade should be through oral instruction or in connection with the reading, and it will frequently be related to work that is taken up in the geography class:

(1) Biographies of pioneers and stories of pioneer life. Sections 12 and 13.

(2) Stories of Indian life.
(3) Columbus and his voyages. Section 4 (a).
(4) Other Spanish explorers: Vasco da Gama, Ponce de Leon, Balboa, De Soto.
(5) Cortez and the Aztecs; Pizarro and the Incas.
(6) French explorers: Cartier, Champlain, the Jesuit missionaries.
(7) The Iroquois: their life, customs, form of government, military organization.
(8) LaSalle and his expeditions.
(9) Magellan and the first voyage around the world.
(10) English explorers: the Cabots, Raleigh, Drake, Frobisher, giving only a brief account of each. For directions for most of the work in this grade, see Sections 11, 13 and 14.

39. Fifth Grade. In the fifth grade the work should begin to assume a more formal aspect and to give the pupils a broader view. (See Section 15.)

(1) Pioneer stories of the home state.
(2) The Huron and Algonquin Indians: their methods of life, tribal organization and customs and military organization. Compare with each other and with the Iroquois.
(3) George Rogers Clark's expedition. (See Volume One, page 273, Section 1.)
(4) Lewis and Clark's expedition.
(5) Fremont's exploration of the Rocky Mountains.
(6) Virginia: cause of settlement; character of the settlers; geography of the country; occupations of the colonists; events: representative government established (House of Burgesses); introduction of slavery.
(7) Social customs: large estates, classes of society, churches and schools. (See Volume One, pages 278-280, and pages 287-289, Sections 3 and 8.)
(8) The New England colonies.
(9) Maryland.
(10) New York.
(11) Pennsylvania.
(12) The Southern Colonies.

For each of these follow the plan for the study of Virginia, and call attention to the most important events only. Details should be omitted until a later date.

40. Sixth Grade. This grade should begin the systematic study of history, heretofore the work having been given

without any reference to chronological order. The work of the year naturally divides itself into two parts:

I. Development of the colonies.
 (1) Virginia: growth of the colony; Bacon's Rebellion; royal governors; changes in the charter; trouble with the Indians.
 (2) New England colonies: Winthrop; forms of colonial government; town meeting; customs and occupations of the people; religious persecution; education; Indian wars: the Pequod War, King Philip's War.
 (3) After the same plan study New York, Pennsylvania, Maryland and the Southern colonies.

II. The French and Indian War.
 (1) Causes; contrast in the French and English methods of colonization; contrast in the treatment of the Indians by the French and the English; minor wars: King William's, Queen Anne's and King George's, giving only brief attention to each.
 (2) Boundaries of French and English territory in America in 1754.
 (3) The Albany Convention.
 (4) Campaigns (See Section 23): Braddock's, Abercrombie's, Amherst's, Wolfe's. (See Section 27.)
 (5) Results. (See Section 24.)

41. Seventh Grade. If the work outlined above has been completed, the seventh grade class is ready to study the Revolutionary War and its results. (See *Use of Text-Book*, Sections 17-30.)

The Revolutionary War:

I. Causes.
 (1) Conditions that led to the settlement of the colonies.
 (2) Navigation Acts.
 (3) The independent spirit of the colonists.
 (4) The effect of the French and Indian War on the colonists.
 (5) The principle involved in the attempt to tax the colonies.
 (6) The Stamp Act.
 (7) Hostile Acts.
 (8) First Continental Congress.

II. Leading campaigns. (Section 23.)
 (1) Around Boston.
 (2) New York. Washington's retreat through New Jersey.
 (3) Burgoyne's invasion. (Section 27.)

(4) Princeton and Trenton. Valley Forge.
(5) Campaigns in the South.
(6) Surrender of Cornwallis.
(7) John Paul Jones and his naval victory.

III. Political events. (Section 24.)
(1) Continental Congress.
(2) Declaration of Independence.
(3) Articles of Confederation.
(4) Treaty with France.
(5) Treaty of Paris; boundaries established.

IV. Financial measures.

V. Biographies of the most prominent men connected with the struggle. These will naturally be studied in connection with the events with which the men are most particularly associated.

The Critical Period

I. Financial condition of the country.
II. Commerce and industry. (Section 25.)
III. State jealousies.
IV. Inadequacy of the central government.
V. Steps leading to the Constitution. (Section 31.)
(1) Attempts to form a Union.
(2) Preliminary conventions.
(3) The Constitutional Convention.
VI. Political Parties.
VII. Adoption of the Constitution.
VIII. Ordinance of 1787.
IX. Organization of the government.
(1) Departments provided for in the Constitution. (See Sections 31-32.)
(2) The President's cabinet.
(3) Hamilton's financial policy.
X. Adjustment of foreign relations.

42. Eighth Grade. The work of the eighth grade is a continuation of that of the seventh, and includes the history of the country from the organization of the national government under the Constitution to the present time. Emphasis can be placed upon the leading events only, and as far as possible the pupils should trace causes to effects:

I. State sovereignty.
(1) The Alien and Sedition Laws.
(2) Virginia and Kentucky Resolutions.

II. Change in political parties.
 (1) Election of Jefferson.
 (2) Purchase of Louisiana.
 (3) Trouble with France and England. The embargo.

III. The War of 1812.
 (1) Causes.
 (2) Leading campaigns.
 (3) Naval engagements.
 (4) Results.

IV. National Prosperity.
 (1) Industrial development. Inventions.
 (2) Social customs, education, religion, literature. Section 28.
 (3) Monroe Doctrine.
 (4) Missouri Compromise.
 (5) Internal improvements.

V. Growth of sectionalism.
 (1) Jackson and the Spoils System.
 (2) Jackson's financial measures and their results.
 (3) Growth of slavery.
 (4) Mexican War and results.
 (5) Contrast of the industrial systems, North and South.
 (6) Contrast of social customs, North and South.
 (7) Compromise of 1850.
 (8) Attempts to extend slave territory.
 (9) Election of Lincoln.
 (10) Secession.

VI. Civil War.
 (1) Organization of the Confederate government.
 (2) Preliminary events.
  (a) Attack on Sumter.
  (b) Call for troops.
  (c) Bull Run.
 (3) Leading campaigns. These can be studied either by years or by the territory covered by each; but it is usually wise to follow the plan of the text-book and thus avoid confusing the pupils.
 (4) The *Monitor* and *Merrimac*.
 (5) Fall of the Confederacy.
 (6) Assassination of Lincoln.
 (7) Financial and industrial conditions of the country.

VII. Reconstruction.
 (1) The different plans presented.

(2) Impeachment of President Johnson.
(3) Election of Grant.

VIII. Return to prosperity.
(1) Centennial exposition.
(2) Resumption of specie payments.
(3) Development of the West. New states.
(4) Construction of railways.
(5) Development of manufactures.
(6) Growth of cities.
(7) Development of the civil service.
(8) Education, religion, literature.

IX. The United States as a world power.
(1) The Spanish-American War.
(2) Hawaii.
(3) Acquisition of the Philippines and Porto Rico.
(4) Influence among other nations.
(5) Struggle for industrial and commercial reform. (See Section 29.)

TEST QUESTIONS

1. When should systematic study of history begin? What previous preparation for this work should the pupils have? Give reasons for your answers.

2. Show how you would teach the right sort of patriotism (1) to classes in the intermediate grades; (2) to classes in the grammar grades.

3. Give a plan for teaching *Paul Revere's Ride* to a fifth grade class.

4. In teaching the French and Indian War, what points should be emphasized? What relation did this war bear to the Revolution?

5. Why are the causes leading to and the results following a war of greater importance than the military campaigns? Illustrate by referring to the Spanish-American War.

6. What has been the influence of the railway upon the history of the United States? How would you teach this fact to a seventh grade class?

7. Why should current history be taught? From what source can the desired information be obtained? What is your plan of teaching current history?

8. Show why it is better to teach the leading facts in civil government as the class reaches them in the history than it is to study this subject from a text-book in the seventh or eighth grade.

9. Why should simple facts of local government be taught before the study of the national government is taken up?

10. What would you teach about your state government to a class prepared to study a text-book in history?

LESSON SEVENTEEN

SPELLING AND PENMANSHIP

SPELLING

1. Conditions. Thousands of young people yearly go from the public schools to business positions in which they are required to make practical application of the knowledge of English which they have obtained. Unfortunately, many fall far short of the standard which they are supposed to have reached; and failure to teach the pupils to spell is one of the most common charges brought against the public schools as a cause of this shortcoming. Results of many tests of pupils made throughout the country show conclusively that in many instances these charges are well founded, and, notwithstanding the fact that the complaints have been reiterated for many years, conditions seem to be but little improved. Methods of teaching spelling, therefore, should receive careful attention.

2. Value of Spelling. Spelling is a practical, rather than a cultural, study, and when considered from a practical point of view it is found to possess commercial value. Business men will not place in responsible positions those who cannot spell correctly. Moreover, most firms are particular about their correspondence, and employers cannot afford to spend time in correcting errors in language and spelling that are made by a stenographer or a clerk. Ability to spell correctly, therefore, is essential to securing and retaining a good position. Lack of this accomplishment keeps many young people in inferior positions, at low salaries.

While emphasizing the practical value of spelling, we should not entirely overlook its cultural value. This is seen in its effect upon the individual. The person who is not sure of his spelling is never at ease when required to write even the simplest form of paper or letter, and the discovery of his errors by another is often humiliating in the extreme.

"It is no particular credit to be a good speller, but it is a disgrace to be a poor one." For these reasons, the importance of learning to spell should be emphasized in the intermediate and grammar grades.

3. Causes of Poor Spelling. In teaching spelling, certain difficulties are encountered, and these must be understood and conquered, if one is to succeed. Among these difficulties are the following:

(a) STRUCTURE OF THE LANGUAGE. The English language is chiefly the result of the union of two languages—the Anglo-Saxon and the Norman-French. But this result has been greatly modified by other languages and by changes due to the dialects used by the early English-speaking people in different localities. The spelling of the Anglo-Saxon and Norman-French was largely phonetic, but changes and interpolations destroyed much of this style; then, too numerous additional changes were introduced by Gutenberg, the inventor of printing, and his immediate successors, who tried to engraft Dutch spelling upon English words. Again, the alphabet does not contain enough characters to represent all the sounds in the language, so that some letters, as *a* and *e*, for instance, have several sounds. In numerous words the spelling does not indicate the pronunciation of the word, and in others the pronunciation does not indicate the spelling.

For some unknown reason, these early spellings were handed down from one generation to another until they were introduced into the first English dictionary. This gave them a permanent character, so that a large number of them, awkward and absurd as they are, have been retained to the present time. There has been, however, considerable progress in simplifying some spellings, and a large number of able scholars are still working on the problem. Because of prejudice and invested interests in dictionaries and other works of reference, the progress of these people is necessarily slow, but gradually the simplified forms are working their way into use. Regardless of this, the standard forms are those generally accepted, and are those which we are compelled to employ.

The above explanations show why there can be but few rules for spelling English words, and one who begins to learn these rules soon finds that each has numerous exceptions. Consequently, the spelling for all except phonetic words must be remembered arbitrarily.

(b) Defective Sense Organs. Primarily, spelling is a form study. The form of the word must be so firmly fixed in mind that it can be reproduced whenever required. Some children are not strongly eye-minded; that is, they do not readily grasp and retain forms. Such children become good spellers only through prolonged practice. Moreover, the eyes of many children are more or less defective, and until this defect is remedied, they do not perceive the forms clearly. Tests often show that poor spellers have defective vision. Again, children who are not eye-minded are usually strongly ear-minded; that is, they perceive words by sound rather than by sight. The spelling of such children is likely to be phonetic; as, *jerney* for *journey; thot* for *thought*, and *site* for *sight*. Defective hearing does not tend to poor spelling, because it throws greater responsibility upon the sense of sight.

While the spelling of some words is not closely related to their pronunciation, in most cases correct pronunciation assists in correct spelling. Pupils who do not understand the pronunciation of a word are more liable to misspell it than those who do. The cultivation of correct pronunciation is therefore of importance.

(c) Lack of Understanding. Pupils spell words much more accurately when they know their meaning and use. To ask children to learn the spelling of lists of words which are entirely strange to them leads to confusion and, often, waste of time.

(d) Haste. In written composition, and especially in writing exercises from dictation, the thought runs ahead of the hand, and this often causes pupils to omit letters or to transpose letters in a word.

(e) Sensitiveness. A child who has a nervous temperament, or who is abnormally sensitive, often becomes con-

fused and writes forms which he did not intend to produce.

(f) Poor Teaching. The results obtained in spelling depend far more upon the methods employed than upon the time spent upon spelling exercises. The teaching of spelling rarely receives the attention which the importance of the subject warrants, and it is probably true that poor teaching is the most prolific source of the poor spelling charged against the schools.

4. Psychology and Spelling. The old definition of spelling is, "The formation of words by letters;" and too many teachers have confined their notion of spelling closely to this definition. If one would be successful in teaching spelling, one must understand the mental processes involved; and examination shows that these are somewhat complex. Considered from the activities involved, spelling is a *sensori-motor* habit; that is, it includes the action of some of the organs of special sense—sight and hearing and muscular movement, which, in oral spelling, brings the vocal organs into action, and, in written spelling, the muscles involved in writing. It naturally follows that all of the activities connected with spelling should be brought to bear upon it. Oral spelling and written spelling are both valuable, and the results of numerous tests show that the highest percentage of accuracy is secured when both are employed. The successful teacher of spelling will, therefore, use all proper means to fix the words permanently in the minds of the pupils.

5. Selection of Material. There are wide differences of opinion among educators as to the sources from which words for spelling exercises should be taken. One group strongly advocates the use of the spelling book, and the other is emphatically opposed to it.

(a) The Spelling Book. Those who advocate the use of the spelling book base their claims chiefly upon the following arguments:

(1) The spelling book contains lists of words, systemat-

ically arranged and carefully graded. These are much better lists than can be prepared by the teacher.

(2) Words selected from various branches pursued by the pupils, while they may meet the immediate needs of the schoolroom, do not give the child a sufficiently broad vocabulary to meet the requirements of later life.

(3) Words selected at random are not graded in the order of difficulty, neither are they chosen according to any system.

(4) In copying words into their note books, children are liable to make mistakes in spelling, and thus provide themselves with wrong forms for study.

(b) Other Sources. The opponents of the spelling book raise the following objections to its use:

(1) Lists of words in most spellers are not suited to the needs of the pupils. They contain many words which the pupil already knows, therefore does not need to study, and many others which he will seldom, if ever, use. Time spent in learning to spell these words is wasted.

(2) Compelling pupils to study words whose meaning and use they do not know destroys all interest in the spelling exercises and therefore violates an important pedagogical principle. One of our leading educators even goes so far as to say, "It is doubtful whether the modern spelling book, with its barren lists of words, made up on the principle of similarity of sound, is not the greatest foe of good spelling."[1]

(3) Since spelling is a practical study, and since in life we spell words only when we write them, spelling should be so related to other studies that its utility will always be apparent. When the spelling book is used, this feature is often lost sight of.

(c) Principles of Selection. Between these opposing elements, with their various arguments, the inexperienced teacher is liable to be left in doubt as to the best course to pursue. If she has a course of study, it usually provides for the work in spelling as well as in other branches; but if without a guide, she is often under the necessity of making

[1] Superintendent W. H. Maxwell.

her own selections. Under such conditions she will find the following principles helpful:

(1) Select words in common use. Mistakes are more frequently made in the spelling of common words than uncommon ones. When the child has occasion to use an uncommon word, he looks carefully at its form, and learns its spelling.

(2) Select words somewhat difficult to spell. Phonetic words, as *man*, *men*, *lake* and *time*, require little or no attention; but such words as *sight*, *journey*, *thought*, *foreign*, and all others containing silent letters, require a great deal of attention, because their pronunciation does not indicate their spelling. The child misspells many common words of this kind because he knew them by sound long before he saw their form, and his tendency is to spell them phonetically. The association between the phonetic form and the authorized form, as in *jerney* and *journey*, must be broken before the child will spell words of this class correctly.

(3) Select the new words from the lessons in the various branches as they are met from day to day. The spelling of these, however, should be in connection with the regular lesson on the branch in which they are found. A list of these words should be kept by the teacher, and the list can occasionally be used for a review lesson.

(4) A good spelling book is usually a safe guide, especially for the inexperienced teacher. In the rural school it is practically a necessity, because the teacher cannot find time to make suitable selections of words for the different classes. The spelling book, however, should not be relied upon too implicitly. Combinations of lessons taken from the spelling book, with others formed of words selected from the different branches, will yield the most satisfactory results.

6. The Lesson. We have already given the psychological reasons for having both oral and written exercises in spelling, but the spelling lesson demands more attention than it usually receives.

(a) ASSIGNMENT. The lists of words selected for spelling should be scrutinized with care. If taken from the spelling book, the list may contain words which the pupils already know. They should not waste time studying these words, but unless their attention is called to them when the lesson is assigned, pupils in the fourth and fifth grades will spend as much time studying words they know as those they need to learn. Words difficult of pronunciation should have their pronunciation given at the assignment of the lesson. In short, all known difficulties to the study of the lesson should be removed when it is assigned.

(b) THE RECITATION. The spelling recitation should be devoted to spelling, and to spelling only. The study of diacritical marks, pronunciation, derivation and kindred topics should be taken up in other exercises. Their introduction into the spelling exercise leads to confusion.

If the exercise is oral, the pupils should pronounce the word after the teacher, then utter each letter distinctly, dividing the word into syllables by slight pause between them; as in spelling *compound*, the pupil will spell *com* (pause) *pound*. If the exercise is written, pencils, spelling slips, or blanks, should be ready for use before beginning to pronounce the words. Secure the attention of the class, then pronounce the word clearly and distinctly, and *but once.* Repetition leads to inattention and carelessness.

If it is a dictation exercise, choose short sentences which the pupils can understand, and dictate the entire sentence at once, but do not repeat it. Give the pupils ample time to write the sentences, for haste leads to poor spelling.

7. Correcting Errors. The correction of errors is the rock upon which many teachers of spelling become stranded. Too many teachers see so many misspelled words, and nothing more, when the important thing is to analyze the errors, and to the extent of your ability discover the causes which led to them.

(1) So far as possible prevent errors. This is even more important than correcting them, since every time the child

misspells a word, he strengthens his tendency to spell it that way again. Many errors can be prevented if, before writing, the teacher calls attention to those words which are liable to be misspelled. Whenever new words are encountered, attention should also be called to their spelling before the class attempts to write them.

(2) Give the pupil opportunity to correct his errors before he passes his work out of his hands. The purpose of the exercise is to train the pupils in spelling, not to see how many errors they can make. The practice of allowing pupils to correct their own errors encourages them and leads them to put their best efforts into the spelling exercise. Furthermore, it is only justice to the children; they should have the same chance to correct their work that you claim for yourself. Doubtless you seldom allow a letter or other piece of written composition to pass out of your hands until you have looked it over for errors in spelling, punctuation and grammatical construction.

(3) The method of correcting errors will vary with the conditions under which the exercises are given. After the pupils have reviewed their exercises, it is a good plan to have them exchange papers, and as the teacher spells the words, have each pupil check the errors on the paper in his possession. When all of the words have been checked, the pupil correcting the paper should sign his name, or place his initial, at the bottom. The papers should then be returned to their owners, who should proceed at once to correct their errors. This matter of correction should not be left until the pupil studies the next spelling lesson; before that time he may have occasion to write the misspelled word several times, and he will repeat the error each time.

(4) Analyzé the errors. This is very important, since it gives a clue to the causes of most of them. Some errors will be found common to the class, and can be treated in special lessons; others will be peculiar to individual pupils, and each pupil to whom this class of errors applies should receive such attention as will enable him to overcome his

difficulty. Some of the errors of this kind are the following: The use of *m* for *n*; transposition of *e* and *i* when they occur together in a word and associating the spelling of words which have similar sounds but are spelled differently, as *scope*, *sope* (soap); *meet*, *wheet* (wheat). The child has both words in mind, and lets the first govern the spelling of the second.

(5) Encourage your pupils to do their best. Emphasize the number of words spelled correctly, rather than the number of errors made.

(6) Have the pupils write, again and again, sentences and paragraphs which will include words they are prone to misspell. Follow up each error until the correct form is firmly established. A few words each day studied on this plan will accomplish much more towards securing good spelling than the learning of long lists of words which receive little attention.

(7) Have each pupil write correctly in the back of his spelling blank the words which he misspells at each exercise; later, give him frequent tests on these words.

8. General Suggestions. (1) The final test of one's ability to spell is one's spelling in written composition. Many pupils who spell words correctly when writing them in columns, misspell the same words in paragraphs, and even in short sentences. Therefore, the plan of having pupils write their spelling exercises in sentences and paragraphs which shall include the words studied, should be adhered to closely.

(2) Avoid too long lessons. Pupils in the fourth and fifth grades can master but a few words in a day. Long lessons lead to confusion.

(3) Seventh and eighth grade pupils can often study the structure of words to advantage. A knowledge of derivation and structure is an aid to spelling. For instance, we are more liable to spell *laboratory* correctly if we know it comes from *labor*. A plan for this work is found in Volume One, pages 140-142, Section 12. The work, however, should be considered as word study, not spelling.

9. Rules for Spelling. Most of the rules for spelling contain so many exceptions that they are of but little practical value. However, the following contain comparatively few exceptions, and can be learned with profit by pupils in the grammar grades. Before they are introduced, the pupils should have a few lessons on vowels and consonants:

(1) Most words ending in silent *e* retain the *e* before suffixes beginning with a consonant; as, *home*, *homely*; *like*, *likely*; *care*, *careless*.

(2) Most words ending in *y* preceded by a vowel, retain *y* before a suffix; as, *gray*, *grayish*; *pay*, *payable*; *journey*, *journeying*.

Exceptions. *Daily*, *laid*, *paid*, *staid*, *saith*, *said*.

(3) Words of one syllable, and words of more than one syllable with the accent on the last syllable, ending in a single consonant preceded by a single vowel, double the final consonant before a suffix beginning with a vowel, except when the addition of the suffix throws the accent nearer the beginning of the word; as, *prefer*, *preferred*; *star*, *starry*; *refer*, *reference*, *referred*.

(4) Words of more than one syllable, with the accent not on the last syllable, ending in a single consonant, do not double the final consonant before a suffix beginning with a vowel; as, *travel*, *traveler*; *group*, *grouping*; *answer*, *answered*.

PENMANSHIP

10. Value. Writing is one of the arts which should be acquired by every child before the end of the school period of his life. While the public schools are not expected to make professional penmen of their pupils, they are expected, and should be required, to so train the children that by the time they have completed the work of the fifth grade they can write an even, legible hand with ease and with a fair degree of rapidity. This is the least that will meet the demands of one's business and social relations. Many positions can be filled only by those who write a neat and legible hand. It is an imposition upon one's acquaintances and friends to send them written communications which cannot be easily read. Moreover, serious mistakes are often made because people do not write plainly. For these and other reasons, writing should receive as careful attention as any other branch in the course of study.

11. Conditions Frequently Met. When pupils enter the fourth grade, all habits are in a formative stage. However careful their previous training in penmanship may have been, correct habits of position and movement are not firmly fixed. After the long summer vacation the children will be out of practice, and some of them, at least, will be unable to recall readily the details which they learned in the previous grade. The writing of many of these children will be characterized by wavy lines and poorly formed letters. Some, especially among the girls, will have acquired the finger movement, and their written characters will be so small as to be scarcely legible.

These conditions are due chiefly to four causes—a faulty position at the desk, the child's inability to control his muscular movements, lack of knowledge of the forms of letters, and spending time and energy during the writing period in copying forms instead of in drills designed to fix correct writing habits. Before good results in penmanship can be secured, these difficulties must be overcome. It is, therefore, well for the teachers of intermediate grades to begin the year's work in penmanship with those exercises which are essential to success in this branch.

12. The Teacher's Viewpoint. Many teachers fail to secure satisfactory results in penmanship because they do not study the problem carefully or plan their work systematically. Penmanship is placed in the course of study that children may be taught to write legibly, easily, and with a fair degree of rapidity. The writing lessons are a means to this end, and the teacher should look upon the work in this branch from the viewpoint of its purpose. Writing, when considered from the point of view of its function in a course of study, is vastly more than the copying of forms. Writing is reproducing with pen or pencil the forms of letters which the writer holds in mind, and the combining of these letters to form the words required to express his thought. Every lesson in penmanship has its psychological as well as its physical or muscular phase. "All principles of pedagogy apply to penmanship."

13. The Teacher's Preparation. Too many teachers overlook the psychological phase, or mind side of the subject, when preparing their writing lesson. Unless this phase of the work is most carefully considered, it is impossible to secure the desired results. "The three essentials in teaching writing are form, freedom and interest."[1] Of these, form and interest belong to the mind side of the subject.

(a) FORM. Before the architect can draw the plans for a building, he must have a clearly defined picture of the structure in his mind. Just as truly must the pupil have in mind definite images of the letters before he can write them. Form, then, is in the mind, and the acquisition of form is a mental process. So long as the child is dependent upon the copybook or the blackboard for the forms of the letters, he cannot express himself in writing. The child acquires the forms of letters by observation, by studying them in books, and by seeing them made on the blackboard by the teacher. He fixes these forms in mind by making them himself. Therefore, the teaching of form is one of the first essentials in teaching penmanship. The steps are (1) observation, (2) formation of mental images, (3) reproduction of the forms learned.

(b) FREEDOM. By freedom is meant the ease and skill which characterize one's writing. The acquisition of freedom constitutes by far the greater part of the work of learning to write, and a large portion of this lesson is devoted to exercises which will enable the teacher to assist her pupils in securing this much desired end.

(c) INTEREST. Interest is the appeal which the subject makes to a child. In nearly all cases the interest which the pupils take in their penmanship depends upon the skill with which the teacher plans the lesson and the zeal and enthussiasm with which she conducts the exercises. The teacher who plans her lessons wisely, and is enthusiastic, will have little or no difficulty in securing and retaining the interest in the writing lessons. All the principles and laws of interest

[1] B. D. Berry: *The Penmanship Trinity.*

which apply to other branches apply here with equal force.

(d) APPLICATIONS. From the foregoing discussion it is clearly seen that the teacher should prepare her lessons in penmanship with as much care as she does those in other branches, and that the lessons should be systematically arranged and properly graded. The teacher should have a definite plan, and should proceed by the most logical steps to reach the end in view.

14. The Elements of Form. In learning to write, the child has to observe, memorize and make sixty-one characters—twenty-six small letters, twenty-six capital letters and nine figures. Were each of these characters formed on an entirely different plan from the others, the task, though somewhat formidable, would not be beyond accomplishment with a reasonable degree of effort. The problem, however, which confronts the child and the teacher is much more simple. These sixty-one characters are all formed from two simple elements—the straight line and the oval, by combining them in different ways. It naturally follows that children who acquire the power to make these elements with ease, skill and rapidity, become free, easy and legible writers. In all drill exercises the teacher should hold this idea in mind. The exercises given in the following pages are for the purpose of showing how the elements are modified and combined to form the different characters and how by their use the pupil may acquire skill in writing.

15. Position. Good position at the desk is essential to free and easy movement. Unfortunately, some school desks are so narrow that the preferred position cannot be taken. The front position is the most desirable, and whenever practical this should be assumed in all writing exercises. The pupil should sit erect, facing the desk, with both feet squarely on the floor. The body should be approximately erect, but may bend forward slightly, provided the bending is at the waist. Keep the spine straight. The pupil should not lean against the desk, nor against the back of the seat. Fig. 1

shows the position of the arms and paper. A is the right arm, B the left arm, P the paper, and D the desk. It will be noticed that the angle which the paper forms with the front of the desk is about one-third of a right angle; in other words, if the line which represents the lower edge of the paper were extended to the right edge of the desk, it would touch a point one-third the distance from the lower to the upper corner.

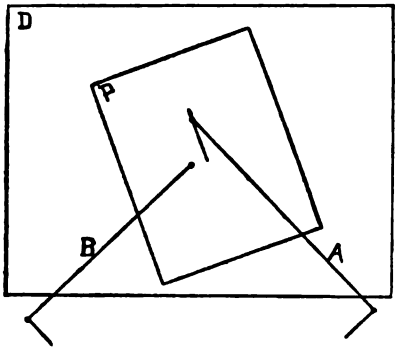


FIG. 1

The desk should be of such a height that when the writer sits erect, and lets his arm drop naturally at the side, the top of the desk will be a little higher than the elbow. For the adult, the writing should be from twelve to fourteen inches from the eye. When writing, both arms should be upon the desk, the right hand guiding the pen and the left holding the paper in position.

When school desks are too small to admit of the front position, the pupils may be permitted to assume a side position, in which the body is turned to the right, so that a line running from the right to the left side will form an angle of about 45° with the front of the desk.

16. Holding the Pen. The pen or pencil should be held loosely between the thumb and the first and second fingers, the thumb coming beside the first joint of the forefinger. The pen should point to the shoulder, as shown in Fig. 2. The ends of the last two fingers are the only part of the hand which should touch the paper, and these


FIG. 2

finger-tips should glide lightly over the page. The first and second fingers should be nearly straight.

The forearm should rest upon the large cushion of muscle between the elbow and the wrist, and the hand should be in such a position that the under side of the wrist is nearly parallel with the surface of the desk, as shown in Fig. 3.

Caution. "Eternal vigilance" is the price of good results in writing. The necessity of insisting upon correct position and proper holding of the pen in every written exercise cannot be too strongly emphasized. Unless the pupils follow the directions given in Sections 15 and 16 until these positions become habitual, they will never make free and easy writers.

FIG. 3

17. Movement. Three movements are recognized in writing. These are the muscular, the arm or whole arm, and the finger movements. While all are used to a greater or less extent, the muscular movement is the only one which should be used for general writing. The finger movement is sometimes combined with this for forming the long stem and loop letters, but such a combination should not be freely resorted to. The arm movement is useful when very large writing is desired, but it is seldom called into use.

In the muscular movement, all forms except the long loops and stems, for which the fingers may be used, are made by the hand and arm, the fingers remaining in a fixed relative position. This movement is the one in general use by accountants, clerks and others who are engaged in constant writing with a pen. It is also the movement taught in business colleges and advocated by most systems of writing introduced into the public schools. It secures the best results with the least effort, and can be practiced longer than either of the other movements without fatigue. The

finger movement, except for purposes already mentioned, should not be allowed. Train your pupils in the muscular movement, if you would secure the best results.

18. Preparation for the Lesson. When the writing period is reached on the daily program, all other work should be set aside, and the teacher should give her entire attention to the writing lesson. The work should be characterized by order, system and despatch. The desks should be cleared, the writing material should be quickly distributed, and the lesson should begin at once. If the pupils care for their own writing material, it should be placed on the desks promptly and quietly. If the material is to be distributed, monitors appointed for the purpose should attend to this duty without any attention on the part of the teacher. There should be enough monitors to distribute the material in about one minute.

19. Material. For drill exercises a good quality of unruled writing paper, $8\frac{1}{2} \times 11$ inches, is the most suitable. The pen should have a smooth point and be of medium grade of fineness. Coarse pens, stubs and very fine pens are not suitable for these exercises, but the children in the intermediate and grammar grades may use a finer pen than those in the primary grades. The penholder should be reasonably large, and composed of cork or rubber. Metallic holders should be avoided, since they are more difficult to hold and cause fatigue in a short time. A good quality of black or blue-black ink should be used.

20. Methods. Before the carpenter can make close joints, he must learn how to use his tools with skill. Likewise, before the child can write easily and legibly he must learn how to use his pen. This fundamental principle is overlooked by those teachers who consider the chief purpose of the writing lesson to be the copying of forms from a writing book. While the writing book furnishes correct forms for study and excellent exercises for occasional practice, and therefore has its place, it should occupy only a limited portion of the time devoted to the writing lessons. It is impos-

sible to secure the necessary freedom of movement by the use of the writing book. The moment the engraved copy is placed before the child, he becomes a slave to it, and position and movement are at once lost to view in his effort to reproduce the forms in the copy. A glance over any writing class which relies chiefly upon the book for practice reveals the futility of attempting to teach writing in this way.

The teacher must therefore conduct many drills which have for their purpose the formation of right habits of position and movement. While freedom is an end sought, it must be remembered that freedom does not mean "license to do as you please," but orderly, well-directed movement. All exercises should have a definite purpose, and the pupil should have this purpose clearly in mind. The old adage, "Practice makes perfect," must here be modified to "Only right practice makes perfect in penmanship."

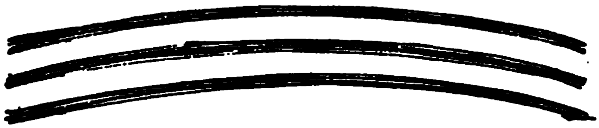
At the beginning of each writing lesson, call attention to position, and see that each pupil assumes the correct position before the practice begins. As the exercise progresses, move quietly among the pupils, correcting faulty positions and wrong movement. It is only by persistent individual work of this sort that satisfactory results can be obtained. Praise effort; encourage those who become despondent; try to see something to commend in the work of each pupil, but criticise defects and keep a high standard of excellence before the class.

21. Preliminary Exercises. The first exercises should be designed to make the pupils feel at ease in the writing class, and to impress upon them the importance of correct position and movement. In these exercises no attempt should be made to form characters.

(1) When the class is in position, with pens in hand, have them move the right hand from left to right and back several times, using as a pivot the cushion of muscle upon which the forearm rests. There should be little or no motion at the wrist joint, and in no case should the wrist joint form

the pivot upon which the hand moves. The hand should glide over the paper on the tips of the third and fourth fingers, as in regular writing.

At first let the movement be made without marking upon the paper. Uniformity of movement is secured by counting. When the class is in position, say, "Ready. Right, left; right, left; right, left; one, two; one, two;" and so on. Continue the counting for about a minute, then pause for



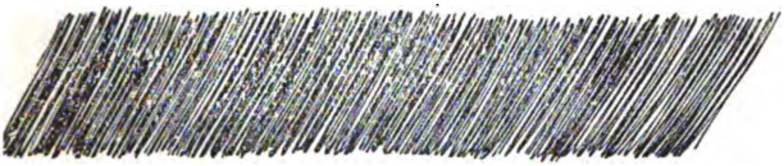
EXERCISE 1

a brief rest. Be sure that the hand is held so that the penholder points to the shoulder. After two or three exercises like this, let the pupils mark upon the paper for a few exercises. The result should be similar to that represented in Exercise 1.

For the first few exercises it may be well to say nothing about the length of the lines, but as soon as the pupils become accustomed to the movement, the length should be restricted so that it will not exceed four inches, and better results are secured with a length of about three inches. Three or four minutes can be spent profitably in such drill at the beginning of each writing lesson.

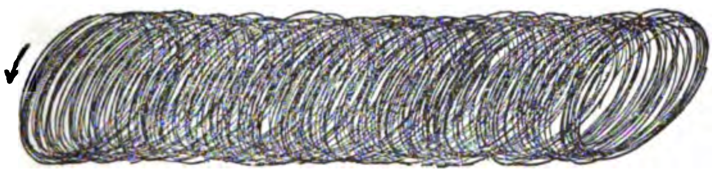
(2) The next drill gives practice on the straight line. The movement is made by allowing the hand to play forward and backward on the paper, while the forearm rests upon the desk, as in Fig 1. The slant will depend upon the way the pen is held, and probably it will not be exactly alike in any two cases. This, however, need not cause any concern. Regulate the movement by counting, as in the first exercise. Begin without marking, and then use the ink. This exercise is more difficult than the first, and there will probably be more irregularity in the work of the pupils. The result sought is seen in Exercise 2.

(3) The third exercise is on the second element of form—the oval. The forward and backward motions are the same as in Exercise 2; but while the hand moves forward and



EXERCISE 2

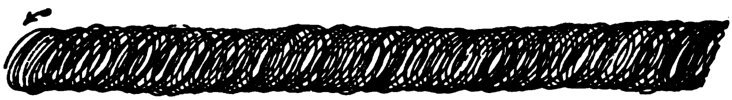
backward, it also moves from right to left, so as to form the oval. Regulate the movement by counting "one" on each down stroke. This exercise should be resorted to again and again, until the pupils can reproduce Exercise 3 with ease and rapidity.



EXERCISE 3

Exercises 2 and 3 should be practiced until they can be written in smaller size, as illustrated in Exercises 4 and 5.

EXERCISE 4



EXERCISE 5

Sixth, seventh and eighth grade children should be able to do this with but little preliminary drill.

(4) The next exercise shows the separate oval, which is the best form for all characters or parts of characters containing curves (Exercise 6). The movement in this drill should be regulated by counting, as in the continuous oval. The drill should be practiced at nearly every writing lesson in the fourth and fifth grades.

EXERCISE 6

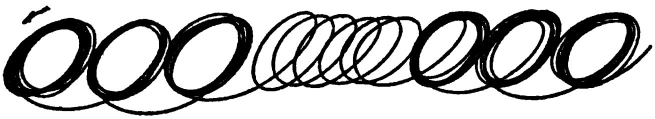
22. Development of Forms. Variety in exercises and plans is necessary to maintain interest. (1) After the pupils have produced the continuous oval in the ordinary way, with the down stroke on the left, let them practice with the movement reversed. This drill should be repeated until the children become as proficient in making the continuous oval with the reverse movement as they are in producing it by the movement shown in Exercises 3 and 5.

(2) Exercise 7 is produced by the same movement as Exercise 6. Joining the ovals by a swing to the right is

EXERCISE 7

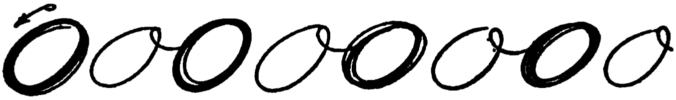
designed to give greater freedom in movement. Count on each down stroke. When an oval is completed, pass to the next on the word *and*; as, "Ready. One, two, three, four, five; and one, etc.," until the line is completed. This is an excellent drill and should be often repeated. From Exercises 6 and 7 the pupils get the idea of the formation of O.

(3) In Exercise 8 an additional step is given, in the formation of the single line ovals in the center of the figure. Observe the directions given in Exercise 3, Section 21.



EXERCISE 8

(4) In Exercise 9 the O alternates with the oval. This exercise shows the pupil's power of control over his movements. If the O's are even and light, he has gained such control as will insure his becoming a good penman.



EXERCISE 9

(5) In Exercise 10 we have a combination of the elements of form. This exercise should be preceded by drills on Exercises 4 and 6, in Section 21. It is more difficult than those which have preceded it. The tendency will be to make the straight lines longer than the long diameter of the ovals. Count on the down strokes. When the class can reproduce this exercise as given, it shows excellent progress.

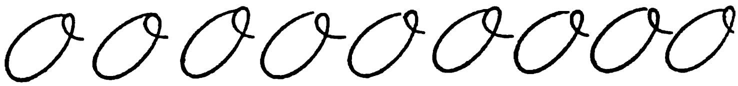
EXERCISE 10

(6) In Exercise 11 the straight lines and ovals are separated, the latter appearing as O's. Count "one" for each O and "one" on each down stroke in the straight lines; as,

EXERCISE 11

"one, and one, two, three; one, and one, two, three," etc. Light lines and even strokes in all characters should be the aim in this drill.

(7) In Exercise 12 the O's are given alone. All steps in the development of this letter are now completed, and the O stands by itself. Count "one" for each O.

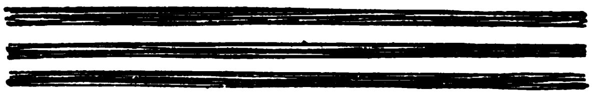


EXERCISE 12

(8) In Exercise 13 we return to the movement with which we began, except that the hand now moves in a straight line instead of over the arc of a circle. Practice the first exercise in Section 21, then change to this:

EXERCISE 13

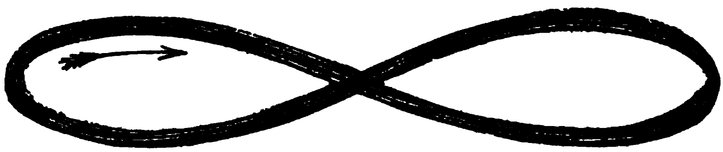
The pupils will discover that the straight line is more difficult to make, and that there must be no motion at the wrist. After practicing a few minutes on Exercise 13,



EXERCISE 14

change to 14. These drills are valuable in training pupils to write in straight lines on unruled paper.

(9) In Exercises 15 and 16 the right and left and oval movements are combined. Produce these forms first by moving the hand as indicated by the arrows, then reverse the movement for an equal number of figures. Exercise 15

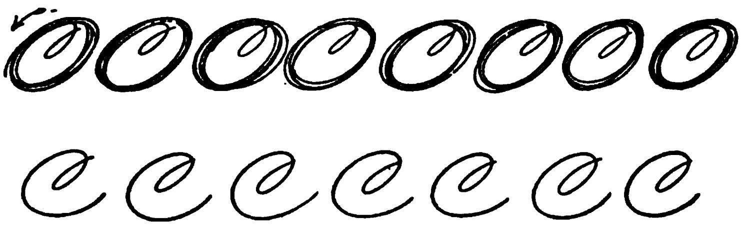


EXERCISE 15

affords good opportunity for practicing the whole arm movement, if this is desired for variety. This is the most difficult exercise yet given, and its mastery marks a good degree of progress in gaining control of the muscles. Exercise 16 reduces the same exercise to one employing muscular movement only.

EXERCISE 16

(10) Exercise 17 shows the evolution of C from the oval. Begin by forming the small loop in the upper part of the oval.



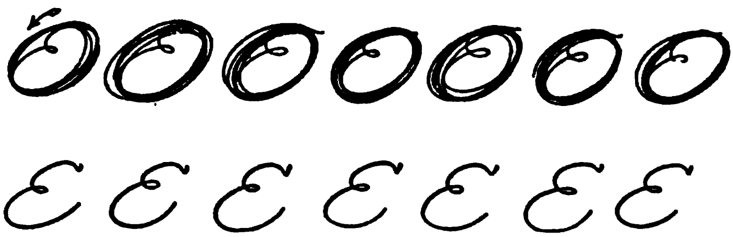
EXERCISE 17

Count as in the formation of other ovals. In the lower line the oval is dropped and the C's stands out alone.

Exercise 18 shows a simpler form of C, but one more difficult to make, because of the small loop at the beginning. The drills on ovals should enable the pupils to make C's of even size and light lines. Practice until this result is reached.

EXERCISE 18

(11) Exercise 19 shows the evolution of E from the oval. Make the oval, then the E within it. Count as in other exercises. In the lower line we have the E standing alone. Many lines of E's should be made.



EXERCISE 19

(12) D starts with a downline line slightly curved, forming the left side of the letter, and ending in a small loop at the bottom. The oval is then made around this, to give an idea of the general form of the letter. Alternate ovals and D's are shown in Exercises 20; practice faithfully until the pupils can form the letter readily.

EXERCISE 20

(13) A is a combination of the oval and the straight line. Exercise 21 begins with the downward stroke indicated by the arrow in the center of the first character. Carry the pen

EXERCISE 21

around, forming the outside of the large oval. Let the pen turn upward to form the right side of the left oval, then bring it down on the first line formed. Practice on these figures until the pupils have acquired the movement. The transition to the A is then simple and easy.

(14) In the formation of P the full straight line and the

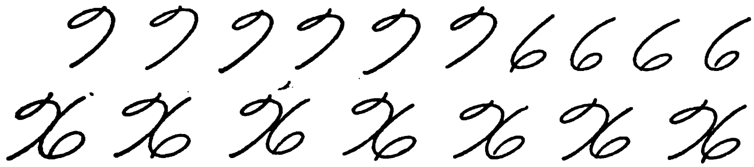
EXERCISE 22

small oval are combined. Practice the straight line first, then join the oval to it. The transition to the letter is evident.

(15) S is formed by the movement which produces Exercise 16 turned in a nearly vertical position. It is a good plan to alternate this drill on the figure with the letter.

EXERCISE 23

(16) Exercise 24 gives the elements used in forming parts of several capital letters. The first four characters of the

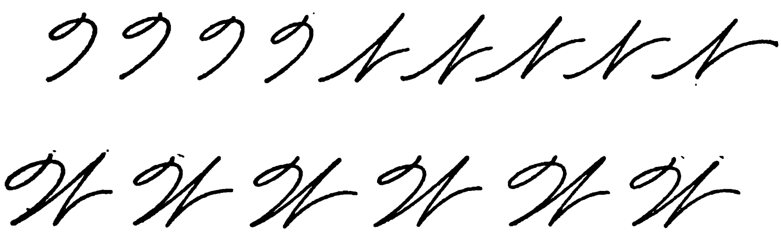


EXERCISE 24

first line form the first part of M, N, W and X; the last six form the last part of X and the figure 6.

The last line of the figure shows the elements combined to form X.

(17) In Exercise 25 we have the elements which unite to form W. The first four characters of the first line are the same as the first four in Exercise 24, and the last five of the



EXERCISE 25

first line resemble *t* when it is written as the last letter of a word. This should first be formed separately and then

united to form W, as shown in the last line of the figure. This capital is usually faulty because pupils do not have a clear idea of its correct form. The drill here given is calculated to fix the form in their minds.

23. Small Letters. No new principles are involved in forming the small letters. The movements already described are used here only on a smaller scale. When loop or stem letters occur in the middle of a word, the fingers are often employed to form the loop or stem, while the regular muscular movement is used in making the other letters. Since the small letters constitute the great body of writing, they require a porportionate amount of practice. One's penmanship is characterized by his small letters. If these are light, even and well formed, one is said to be a good writer. A pupil's writing is poor just to the extent that his small letters fail to reach the standard here given.

The teacher should illustrate the evolution of the small letters, and lead the class to see clearly how the drill exercises are related to their formation. Always keep the simplicity of the problem in mind. When the pupils have learned the foundation movements well, they have practically learned to write.

(1) Exercise 26 again introduces us to the straight line drill, and shows how *j* is developed by this exercise. Have the pupils make several lines of these figures, then change

EXERCISE 26

to the letter, and write a page or more of *j*'s. Continuous practice on one character is necessary until the class has acquired the ability to make it easily and in good form; in this way every lesson is a step forward.

(2) Small *p* combines the stem and loop. It is well to use the straight line drill with this exercise also. Exercise 27 shows a good style of letter and one easily made. This

EXERCISE 27

is a somewhat more difficult exercise than the preceding, and it will require considerable practice.

(3) Small *g* combines the oval and the loop below the

EXERCISE 28

line. The loop is most easily made by the finger movement. Exercise 28 furnishes a good copy for this exercise.

(4) The change from *g* to *q* is very simple, as shown in Exercise 29. The loop is made by carrying the hand to the

EXERCISE 29

right of the downward stroke, and joining the line thus formed to the first line just below the oval. This movement is not used as frequently as that employed in making the *g*, and the exercises will require frequent practice.

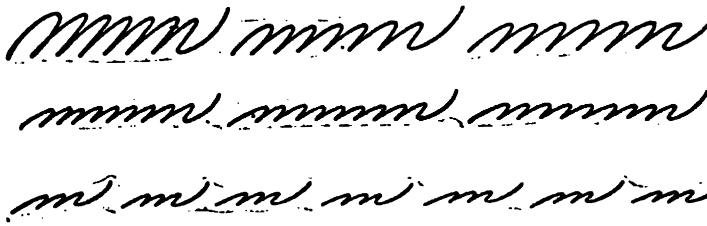
(5) Exercise 30 illustrates the formation of *z*. The part of the letter above the line will require care, since it calls

EXERCISE 30

for a movement not often made. It will also be noticed that the down stroke in the loop bends to the right more than in the *g*.

(6) Exercise 31 is a drill exercise which should be used as a preparation for *m* and *n*. This exercise is evolved from the reverse oval by making a narrow curve with the upward stroke and a straight line with the downward. This drill

should be practiced until the movement produces small, even lines, as shown in the second line. From this the transition to single letters (as shown in the last line of the figure) is very easy.

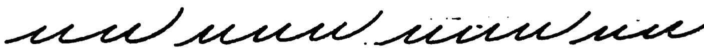


EXERCISE 31

Combination of *m* and *n* and grouping of m's should follow.

EXERCISE 32

(7) Small *u* is formed with the same movement as *m* and *n*, except that the curve is at the bottom. Exercise 33 gives a good exercise for practice. It should be noticed that *i* is one-half of the *u*, with the dot above.



EXERCISE 33

(8) In *o* we return to the complete oval. Make the characters small and even, and join them as shown in Exercise 34. The *o*'s should cross the page in straight lines. If pupils find it difficult to do this, return to Exercise 12, Section 22.

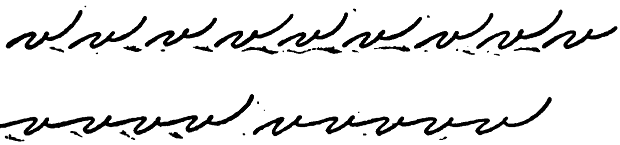
EXERCISE 34

(9) Small *a* has the same form as the *a* practiced in Exercise, 21 Section 22. When pupils have gained control of their muscles, they should find no difficulty in reproducing

the copies as shown in Exercise 35. The directions given for small *o* apply here, as well.

EXERCISE 35

(10) In making *v*, Exercise 36, notice that the first part is the first part of *n*, and that the upward stroke forms a part of the oval, but the hand is carried to the right, leaving the oval open at the top, and the letter is finished with a small loop and an upward movement of the hand. Connected letters, shown in the lower line of the figure, should constitute an exercise following that of the separate letters in the upper line.



EXERCISE 36

(11) From a study of Exercise 37 it will be seen that *x* consists of the first part of *n* and a straight line. Make the curves first, then cross with a straight line.

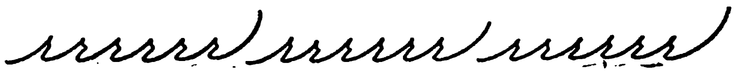
EXERCISE 37

(12) In small *s* we have a letter slightly higher than *a*, *o* and *n*. A common fault in making this letter is failure to close it at the bottom. The s should receive careful attention in the drill exercises.

EXERCISE 38

(13) Small *r* (Exercise 39) is the same height as *s*, but it is more difficult to make. The formation of the upper part of the letter requires care. This letter is often so faulty

that it is illegible; therefore, it should receive a good deal of practice.



EXERCISE 39

(14) Small *d* (Exercise 40) consists of a small *a* joined to the stem, which, as in the illustration, is often written in the form of a loop.

EXERCISE 40

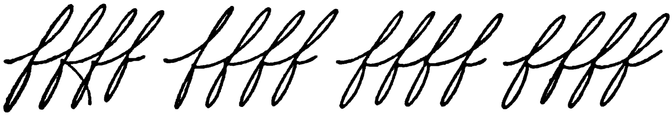
(15) Small *b*, Exercise 41, consists of a loop with the right-hand part of the *v*. The tendency in making this letter is to give too much slant to the stroke forming the lower part. Considerable practice is necessary to overcome this tendency.

EXERCISE 41

(16) Small *k* (Exercise 42) consists of the loop and a character resembling a small capital *r*. The lower part of the letter requires careful attention.

EXERCISE 41

(17) Small *f* is the longest of the small letters. It consists of the common loop above the line and the *q* loop below. The line forming the left side of the loops should be nearly straight. The tendency is to give this line too great a curve.



EXERCISE 42

(18) The exercises for practice on page 230 will be found helpful and will lend interest to the work in the upper grades.

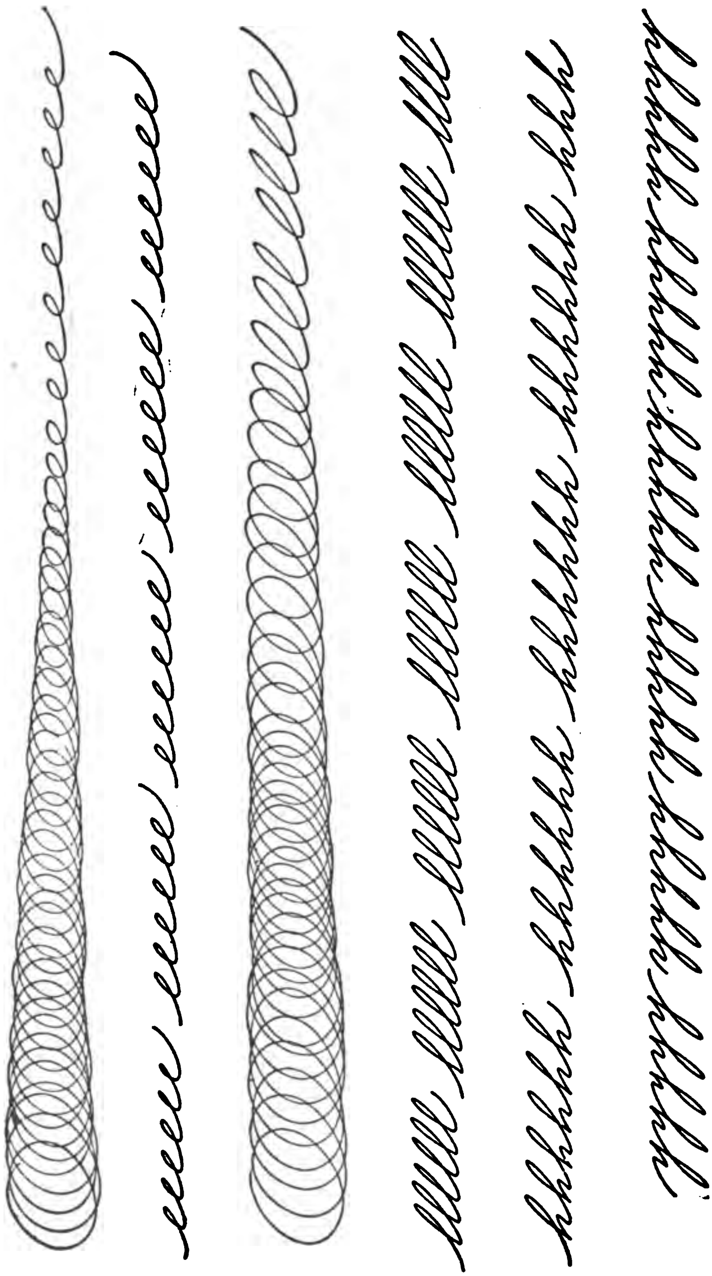
24. Relation to Other Subjects. Penmanship is closely related to all branches in the course of study into which written exercises enter. It frequently happens that in their written exercises in other branches the pupils violate all the principles which they have been taught in the writing lessons. So long as this state of affairs is allowed, good results in penmanship are impossible; therefore, through the intermediate grades, at least, every written exercise should be an exercise in penmanship, to the extent that correct position and movement are maintained. Written exercises in the fourth and fifth grades should be short, so that the pupils can have ample time to write them. Undue haste and lack of supervision in these exercises is one of the most prolific causes of poor writing found in the public schools.

25. General Suggestions. The following suggestions will be found helpful in planning and supervising the work in penmanship.

(1) Study is as essential as practice. Study yourself and lead your pupils to study the forms of the letters and the movements necessary to write them. You cannot reach high ideals by haphazard work.

(2) It is easier to form right habits than to break off wrong ones. See that each exercise in writing helps to fix proper habits of position and movement.

(3) Give attention to the little things. See that the writing material is kept in good order, and that it is so arranged that it can be distributed quickly. Make such changes of seats as will most nearly adjust the height of the desk to the pupils. Have the work for each lesson ready before the writing period arrives. Give such other attention



EXERCISE FOR PRACTICE

to details as may be necessary to make the work move along in a pleasing manner.

(4) Do not be discouraged nor allow your pupils to become discouraged over the results of the first few lessons. If the pupils have never used the muscular movement, they will not write as well by this movement at first and will want to continue in the old way. Impress upon them the importance of learning how to use the pen. When this is learned, all letters are easily made.

(5) Intersperse drill and regular writing in nearly all the writing lessons. This gives variety and enables the pupils to feel that they are learning to write.

TEST QUESTIONS

1. To what extent are rules for spelling valuable? Show why the application of these rules is limited.

2. Do you favor the use of the spelling book? What advantages do you see in its use? What disadvantages?

3. What instruction for studying their lessons from a spelling book would you give pupils of a fourth grade?

4. Explain your method of correcting errors in your spelling classes. In what respects do you find it defective? How can these defects be remedied?

5. Show how a study of derivation in the grammar grades assists pupils in learning to spell.

6. Show the importance of having children form good writing habits before they complete the fifth grade.

7. Why is attention to slant of little importance? How is form learned?

8. Give an outline of the preparation which you make for your penmanship lessons.

9. What are your greatest difficulties in teaching penmanship? How do you overcome them?

10. Why is penmanship so often neglected in schools? What are the most prolific causes of poor writing?

LESSON EIGHTEEN

CONSTRUCTION WORK

REED MATS AND BASKETS

1. Introduction. The chief problems to be considered in the introduction of industrial arts into the public schools are the ability of the teacher to do the work, the equipment with which the school can be provided, and the material to be used. It is the purpose of the following exercises to show how these problems can be solved.

First, the teacher can learn to do the work by doing it as directed in the exercises here given. Before attempting to introduce even the simplest of these exercises into the school, she should construct the object to be made; and if she encounters difficulties, she should repeat the exercise until she acquires the skill necessary to enable her to teach the class. Second, the problem of equipment is easily solved by the selection of such exercises as require few or no tools, like those given on the following pages. The solution of the third problem is found in the material employed in the constructions given. The expression of thought through wood necessitates a more or less elaborate equipment of tools, and children in the lower grades are usually denied this material. There are, however, mediums through which thought may be expressed by younger children that require almost no tools, and work with them may be carried on in the regular classroom, without disturbing the pupils at work in the various rooms, or in other branches in the same room.

Each set of exercises is entirely separate from the others, and can be taken up without any reference to them. While basketry is given first, it does not necessarily follow that the teacher should begin her work with the construction of baskets. She may begin with the raffia work, or with the paper and cardboard work, if conditions are such as to make the selection of either of these sets more advisable. In

general, it is wise to begin with those exercises with which you feel you will succeed the best, and which the conditions and the time seem to make most suitable. This lends interest to the work, and also enables the pupils to see that they are working for a definite purpose.

2. Materials. The most familiar materials used in basketry are rattan, tilo and raffia. *Rattan* is a stout cane which comes to us from China, India and Japan. It reaches this country in the crude state, and is then cut up into caning, pith and rattan. The polished outer surface is removed in flat strips, and is called *caning*. This is used in weaving chair seats. The remainder of the cane is cut into flat and oval lengths having an unpolished surface. The part used for basketry, and commonly called *reed*, is the oval part. This reed is sold by the pound and is designated by numbers beginning with No. 0. No. 0 is very fine, and No. 8 is very coarse. No. 1 and No. 4 are best for school use. The price varies according to number, No. 1 costing about 75 cents per pound; No. 2, 60 cents; No. 3, 55 cents; and No. 4, 45 cents.

The material should be soaked for about ten minutes before using. Too much soaking is bad for the reed. It not only discolors it, but also causes it to become very brittle.

Tilo strands are the shavings from a fir tree. These are a Japanese product. The trunk and large branches of the fir tree are steamed, and then, by using a kind of plane, these clever natives cut the wood into long, straight shavings. *Tilo matting* is a soft, pliable material made of the tilo strands. It may be used in a variety of ways, and is as easily worked as cross-stitch canvas. It is a very absorbent material, taking color as freely as any fabric.

Raffia is the outer covering of the palm leaf. It grows in Madagascar, where the natives dry it and twist it into coils, or make large braids of it. It is then baled and sent to this country in large quantities. It is often mistaken for a kind of grass. Nurserymen find it useful for protecting shrubs and young trees from cold.

All of these materials may be purchased of the School Arts Supply Company, Lockport, Illinois, and most other general school supply houses.

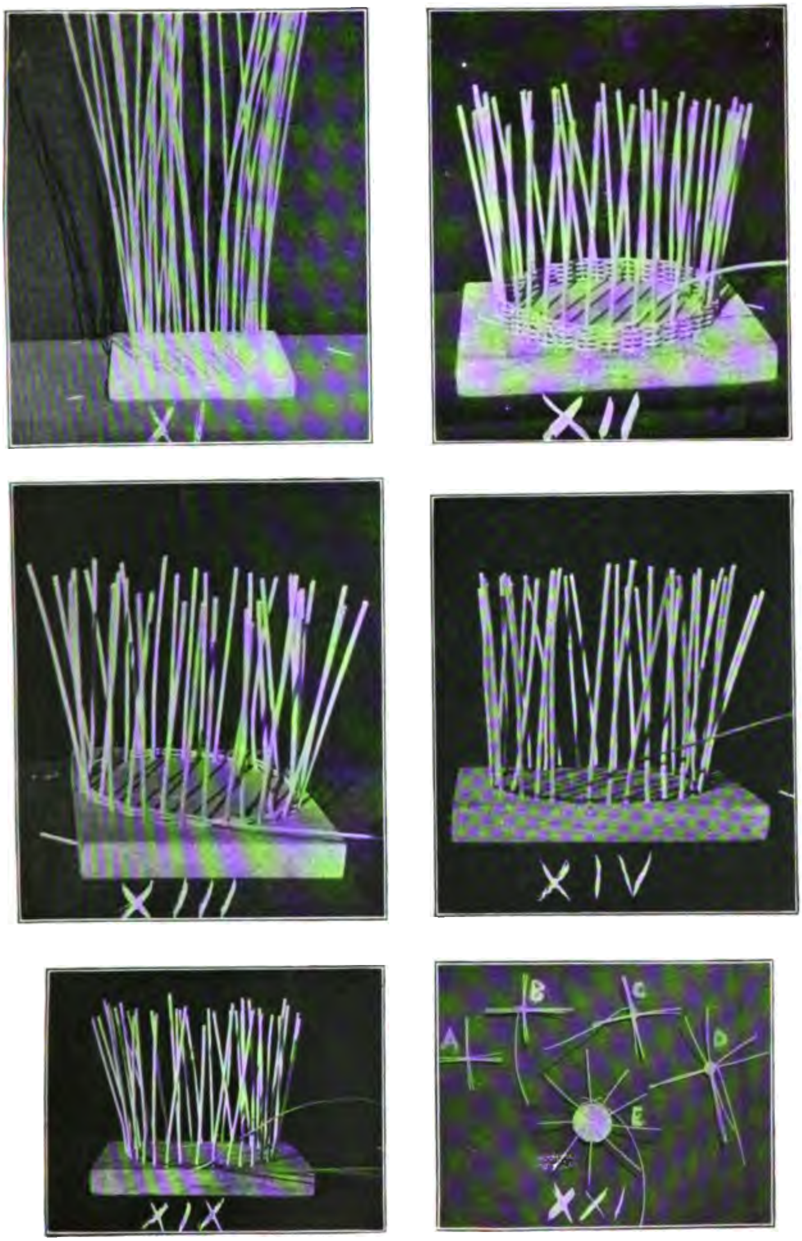
3. Preliminary Steps. Basketry should rank high in the industrial arts of the schoolroom. It requires practically no tools, and admits of great variety as to form and color. In the weaving of baskets and mats there are unlimited possibilities in design. Much has been done spasmodically in the way of basketry. The results on the whole have been poor, which is due largely to poor teaching. No pupil should be allowed to take up a second step in weaving until he thoroughly understands the first. He must understand that no basket can be firmly made unless its foundation is right. As far as possible, each child should be so guided in his work that he can answer his own questions after experimenting.

The material used in basketry consists of the uprights, called *stakes*, and the strands woven around the stakes; these strands are called *weavers*. One who has woven understands that in order to weave continuously with a single weaver, there must be an uneven number of stakes. The child does not know this.

To assist the child to answer many questions concerning the number of stakes, the kind of weave, etc., take a small board, any size and thickness, and draw on it a circle not less than 3 inches in diameter; divide the circumference of this circle into spaces $\frac{7}{8}$ of an inch apart, and bore holes large enough to receive pieces of No. 4 or No. 5 reed. Slender twigs of willow adapt themselves to basketry, and may be used just as successfully as reed, as shown in Fig. XI.[1] This is not a basket, but it is used to illustrate to the pupils the different weaves, and how the weaving is done. The spaces in the circle should not be equal, as one hole is to hold a peg, which may be taken out in order to get an odd or an even number of uprights.

This arrangement makes it possible for a pupil to answer

[1] The figures in this and the following sections refer to corresponding numbers in the halftone plates.



BASKETRY

such questions as the following: Why must there be an uneven number of stakes in simple, continuous weaving? Why does an even number give the striped effect in double weaving, when one weaver is colored? How is the Indian weave with an even number of stakes brought about? The same arrangement also makes it possible for the child to make many discoveries in weaving.

4. The Different Weaves. (a) SINGLE WEAVE. Fig. XII shows the single weave, using an odd number of stakes. Fig. XIII shows the single weave, with an even number of stakes. Fig. XIV shows the Indian way of using a single weaver on an even number of stakes. When the weaver gets around to where it started, it passes behind two stakes, and the weaving is continued as before. The next time around, when the weaver reaches the starting place, it passes behind two stakes again. This is true each time around. To make the illustration more easily understood, different colors have been used in order that the course of one weaver may be more easily followed. The reed is easily colored with vegetable or with aniline dyes, using directions as given under *Dye Stuffs* (Sections 21 and 22). Fig. XV shows what may be done in the way of decorations, by using a single weaver and an even number of stakes. At the point marked "2", is shown the way to change from one course to another. Several rows may be woven before changing courses. A band of this style of weaving may be used as the decorative feature of the basket.

(b) DOUBLE WEAVE. Fig. XVI shows the handling of two reeds as weavers. In using two or more weavers, the one at the left hand is known as the *rear* weaver, and the right hand one as the *forward* weaver. Weaving is always done from left to right, except in cases of special design. This will be explained later. In the double weave, two weavers are put behind two consecutive stakes, and project forward to the right. The rear one goes over the forward one and in front one stake, then behind one stake and out between the next pair of stakes, to the right of the forward weaver.

Fig. XVI shows the effect of a double weaving when one weaver is colored, and an even number of stakes are used.

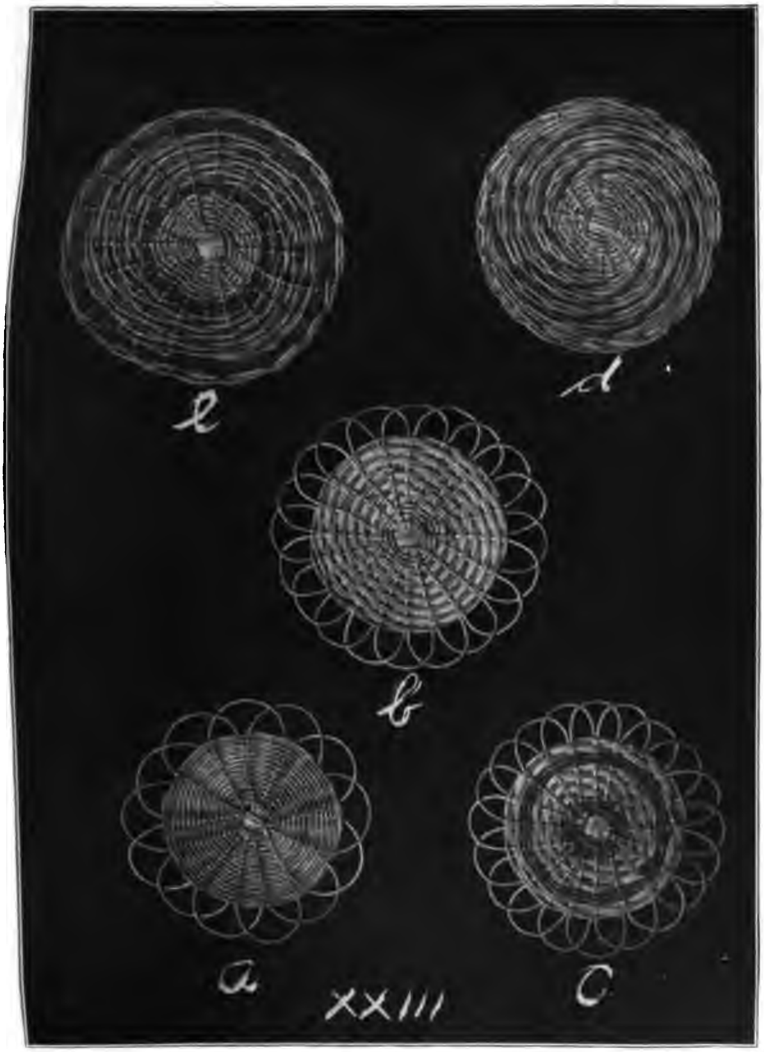
The end of a new weaver is inserted behind and beside the end of the one already woven in. The weaving is then continued. When the basket is finished, these ends may all be cut off flush with either the inside or the outside of the basket, as the case may be. New weaves are introduced in the triple and quadruple weaving in the same manner.

(c) TRIPLE WEAVE. Fig. XIX shows the beginning of the triple weave. The weavers are arranged behind three consecutive stakes and project toward the right. The rear one goes over the other two and in front of two stakes behind one stake, and out between the next pair of stakes, to the right of the forward weaver. The one that was the middle weaver now becomes the rear one, and it, in turn, is treated as the rear one was. Always be sure to take the rear weaver and bring it out between the pair of stakes, to the right of the forward weaver, Very effective results are produced in the triple weave when the number of stakes is exactly divisible by three, when the number of stakes is divisible by three with a remainder of one, and when the number of stakes is divisible by three with a remainder of two. Ample opportunity for experiment should be given.

(d) QUADRUPLE WEAVE. The quadruple weave is done the same as the triple weave, only four reeds are inserted. Very interesting results are obtained by weaving one, two or three colored weavers.

Fig. XX shows finished baskets.

5. Mats. To put into actual practice what has already been given, plan to make a mat, as this embodies all the constructive features found in the bottom of a basket. Soak a No. 4 and a No. 2 reed until both are pliable. From the No. 4 reed cut four 12-inch spokes and one 7-inch spoke. With a darning needle split three of the 12-inch spokes in the center. This is done by boring the needle through the reed and then pulling it so it splits the reed. These incisions must be long enough to allow the remaining number of



MATS WOVEN FROM REEDS

(*a*) Simple weave; (*b*) Indian weave; (*c*) Indian weave with border; (*d*) triple weave; (*e*) weave with colored bands.

This work is of material that can be obtained with little or no expense, and it can be done successfully in any school.

spokes (three) to pass through them. Push half the length of the remaining two 12-inch spokes through the three incisions, as shown in Fig. XXI (a). The four spokes, now in groups of two, are lying at the right angles to each other, forming upper, lower, right hand and left hand groups.

Place the 7-inch spoke between two of the 12-inch spokes, pushing it just through the incisions, as shown in Fig. XXI (b). This gives the odd number of spokes necessary for plain weaving. The end of the weaver of the No. 2 reed is pushed through the incision, as shown in Fig. XXI (b). The weaver is then brought to the right, in front of the vertical group, back and down behind the horizontal group, thereby binding its own end to the spokes. It then comes to the left, across the vertical group, back and down behind the horizontal group to the left, back to the place from which it started. It follows the same course once more, until it has been around the group twice, as shown in (c). The next time, instead of coming down across the group of horizontal spokes to the right, it breaks back, or is reversed, over the horizontal group to the left, and follows the opposite course around twice. The next time around the spokes are separated and the under and over weaving commences, as shown in (d). If one weaver is too short to bring the weaving to the desired size, join the weavers as shown in (e), and continue the weaving as though the weaver were continuous. Be careful to keep the weaving close together, with the left hand, each time it goes over and under the spoke.

Fig. XXII shows the way the mat is held with the left hand in the beginning of the work, while the right hand does the weaving. Be sure to hold the spokes out straight. The weaver must adjust itself to the spokes, and not the spokes to the weaver. When the spokes are all the same distance apart, and approximately in the same horizontal plane, the weaving is placed on the flat surface. The spokes are held down with the left hand, and the weaving is done with the right. When the weaving is completed, the edge of the mat is overcast. To do this, first cut off the weaver

long enough to go a little more than once around the circumference. Begin overcasting, as shown in the illustration, by bringing the weaver from behind one spoke, over the next spoke to the right, and through the last row of weaving just before it gets to the following spoke. Continue this process until once around, then cut off the weaver back of the last spoke.

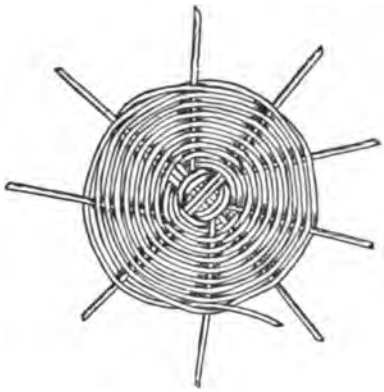
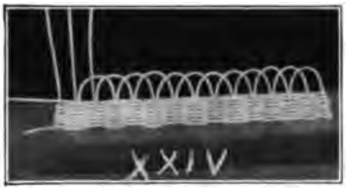


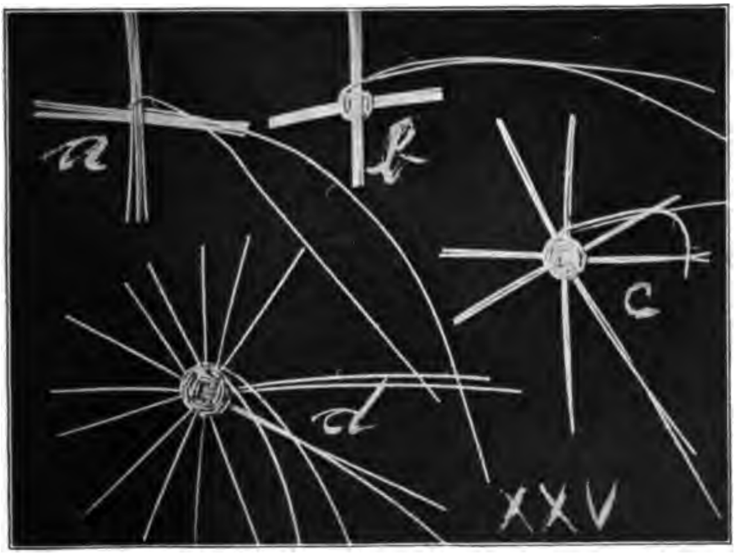
ILLUSTRATION OF OVERCASTING

The mat is now to be finished with an open border, as shown in Fig. XXIII (a).

Fig. XXIV shows a very simple way of illustrating to a class how open borders are made. Looking from right to left, we find in the illustration that one spoke goes in front of the next, and inserts just before it gets to the third. If the spokes are about one inch apart, it will require about 2¾ inches, outside of the overcasting, to finish the border. A very effective border is made where the first spoke goes in front of the second, and inserts just before it gets to the fourth. This requires about 4½ inches outside of the overcasting. A third finish allows the first spoke to go in front of the third, and insert just before it gets to the fifth, and requires from 6 to 7 inches beyond the overcasting. In each case the end must be sharpened and inserted 1 to 1½ inches.

Fig. XXV shows the method of starting a center with the pairing weave. Half the reeds are split, and the other half are pushed through these incisions to form a perpendicular cross, as shown in Fig. XXV (a). The weaver is pushed through the incision, so that one-half is to the right of the vertical group, and the other to the left. The split pieces are held vertically, and the weaver, doubled in the





BASKETRY

middle, is started around the vertical group (a), and under the horizontal group. The rear weaver is brought over the same horizontal group.

The whole group of spokes revolves in the hand from right to left, until the horizontal group becomes the upper vertical group. The weaving is continued first with one weaver and then the other, always allowing one to pass under the group, and the other over, as shown in (b). After going around several times in this way, begin to separate the spokes into pairs, weaving first with one weaver and then with the other. After the spokes are spread apart, as at (c), single spoke weaving may be commenced by weaving first with one weaver and then with the other, as in (d). Single weaving may now be started by weaving once around with one weaver, until coming to the other weaver. The other weaver is then woven around until it comes to the same position as the first. In this way, first one and then the other, each as a single weaver, is used until the mat, or bottom of the basket, is finished.

To make a mat, decide first upon the size. Cut the spokes equal in length to the diameter of the mat, plus the length required to give any one of the above named finishes. To make a basket, decide first upon the size of the bottom and depth of the basket. Cut spokes equal in length to the diameter of the basket, plus the depth of the basket, plus the length required to give the desired finish.

Fig. XXIII (b) shows a mat of Indian weave and open border; (c) shows an Indian weave with a band of color; (d) shows a mat with triple weave, two strands of natural reed and one of color, with an odd number of spokes; observe the close finish; (e) shows the triple weave, with a band of color in single weave.

6. Baskets. If a basket is to be made, the spokes are turned upward after a thorough soaking, as shown in Fig. XXVI. In weaving the first time around, the stakes do not stand erect, as shown in (a). After weaving around several times, the stakes take a more erect position (b).

The spokes, which now become stakes, are turned so that the weaving may be continued from left to right.

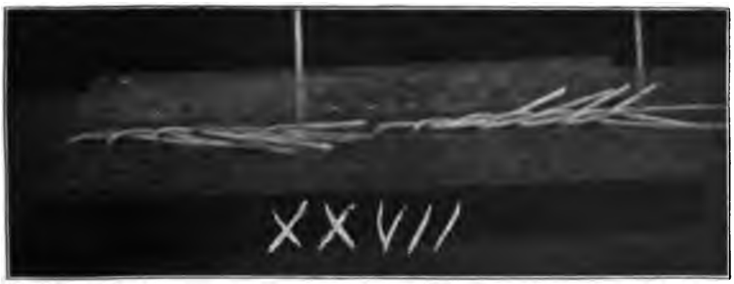
Fig. XX shows the various ways in which the upper edge of a basket or mat may be finished, after being overcast. The weaving of this close finish is started on the side nearest to you, and continued from left to right, as shown in Fig. XXVII. The starting spoke is pushed behind the one to the right and out; No. 2 is pushed behind No. 3 and out, and so on around the top, the last spoke going behind the first, and out of the loop left by it in going behind No. 2. Pull all ends tightly, as shown in the left-hand part of Fig. XXVII. For the second row, start with any spoke, put it in front of the next to the right, and through the loop, into the inside of the basket, as shown in the right-hand view in Fig. XXVII. The ends are cut off just inside of the border and close to it.

Another way to finish the top is to allow each spoke to go to the right, behind two, and out. In the next row, in front of two and through to the inside. A third way is to allow each spoke to go behind one and out, and then in front of two to the inside.

The way to begin a sixteen-spoke center is to let four pieces cross four pieces, and two rows of pairing are woven around the groups of four's before starting in two's. Weave around two's twice, and then separate into single spokes. The way to begin a center having twenty spokes is to let five cross five. Three rows of pairings are woven around the groups of fives. Each group of five is divided into two's and one, making eight pairs and four single spokes. These are woven around twice and then separated into singles.

EXERCISES IN KNOTTING

7. Twine Holder. Select eighteen long, smooth strands of raffia. Place the ends of one strand together, thus making a loop at the center. Hold a pencil, or round stick, horizontally in the left hand; bring the loop over the top of the pencil from the back, and pass the two ends up through



BASKETRY

the loop, pulling them down until the loop is held close to the pencil. (Fig. I, a.) In this manner loop the remaining strands on to the pencil. The knotting is done working from left to right. Leaving one strand on the left edge, knot the second and third strands. Hold the two strands together. Bring the two ends up and around to the back, across the back of the two strands and through the loop to the front. Pull the ends down into place, leaving the knot one-half inch from the pencil. Continue in this manner, knotting the fourth and fifth, the sixth and seventh. One strand will be left on the right side, corresponding to the one on the left side. In knotting the second row, two strands are left on each side. Tie until the knots assume a V shape (b).

The pencil is now slipped out, and a braid of raffia is run through the loops. This finishes the top of the twine holder. The first two loose strands at the top are knotted together; then the two pairs which follow, and so on until the loose strands are all knotted. Gather up the bottom of the holder, tying it with a strand of raffia. Cut the ends of the strands a uniform length. (c) shows the finished twine holder.

8. **Shopping Bag.** Draw and cut from light weight straw board an oblong 10 inches by 8 inches. On each 8-inch edge, close to the upper 10-inch edge, cut notches. Use two braids of raffia for draw strings. Place one braid around the oblong, tying in the left-hand notch; place the other braid around the oblong, tying in the right-hand notch. On each side of the oblong, and over both braids, loop 20 strands of raffia, as directed in the exercise for the twine holder. We will handle these strands of raffia in pairs (See Fig. II). The two outer strands will be knotted around the two inner strands. Hold the two inner strands in the left hand (Fig. III, a); place the right hand strand over the two inner strands (b); bring the left hand strand down over the part of the right hand strand which lies on the left of the two inner strands (c). Now the left hand strand is passed along to the right, under the two inner strands, and up through the loop formed by

the right hand strand (d). Pull the right and left ends outward. This completes the first half of the knot (e). To begin another knot, the left hand strand is placed across the two inner strands, as in (f). The right hand strand is brought

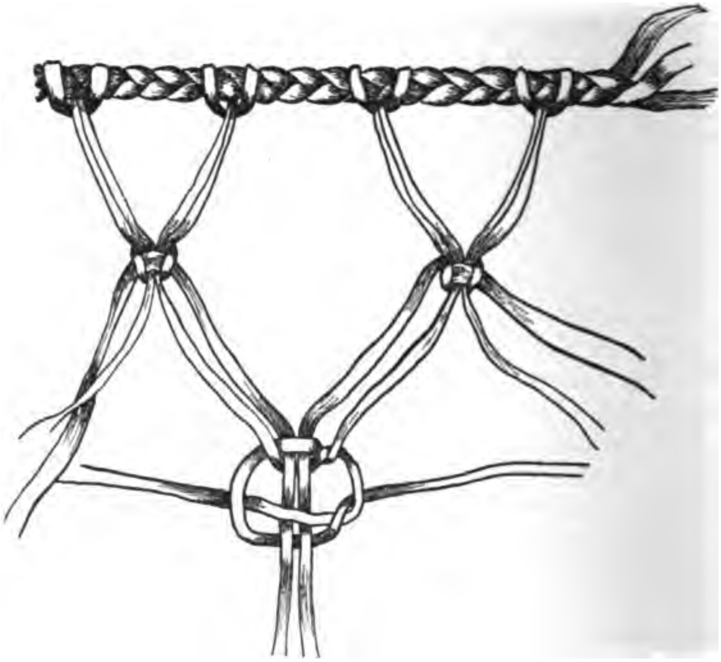
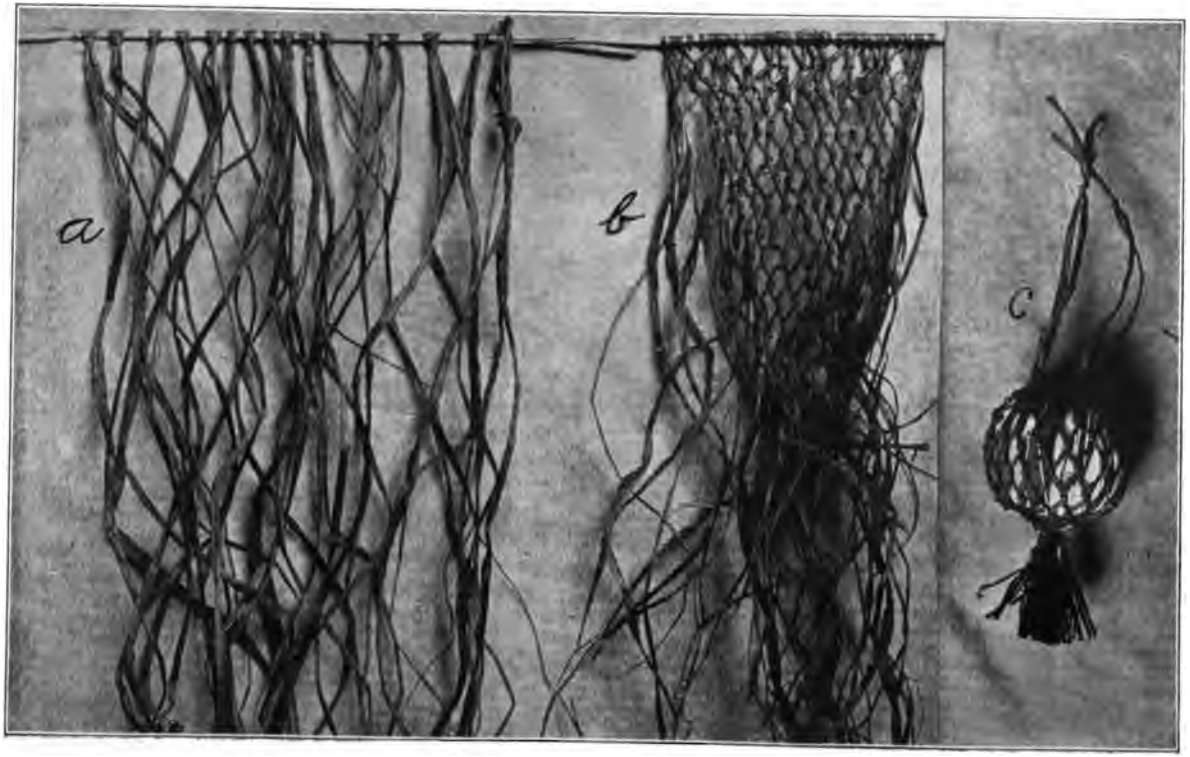


FIG. II. SOLOMON'S KNOT

down over the part of the left hand strand which lies to the right of the two inner strands (g). Now the right hand strand is passed under the two inner strands, and up through the loop formed by the left hand strand (h). Pull the ends outward, one to the left, one to the right, and you will have a finished flat knot (Fig. II), called *Solomon's Knot.* Continue in this manner, handling the next two pairs, and so on, until the first row of knots, going across both sides of the oblong, is completed. In the second row the right hand strand of one knot, and the left hand strand of the next knot, are



RAFFIA WEAVING. FIG. 1

held together, and the knot is tied with the two strands on either side of them (Fig. II).

Care must be taken to keep the meshes even. When the bottom of the oblong is reached, the two sides are joined

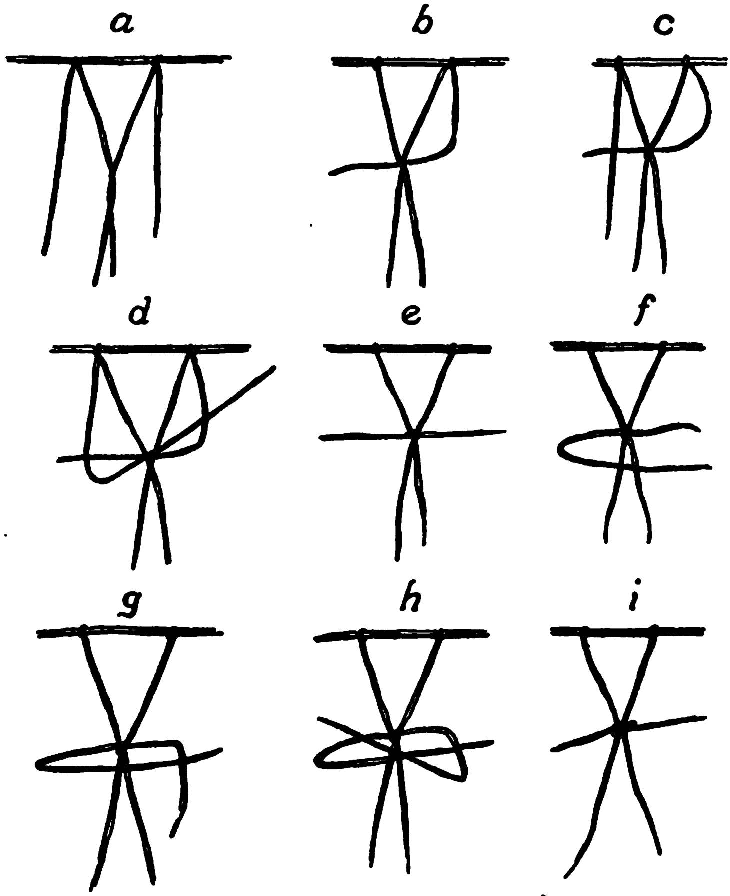


FIG. III. METHOD OF TYING A SOLOMON'S KNOT

at the bottom by placing the meshes and knots evenly together, and tying together a knot from the front and a knot from the back, with two of their outside strands. Cut the ends of the raffia a uniform length to make a good

finish. A pretty twine holder may be made in this manner by splitting the strands of raffia and making smaller meshes.

9. Knotted Work Bags. Secure a small brass ring. Into it loop eight long, red strands of raffia, as described in Section 7; or, loop seven strands on one, as shown in Fig. IV (a), and tie the ends of the foundation so as to form a ring in the center. The tied ends are dropped, making the eighth pair (b). We will call those strands *leaders*. The knot in this bag is tied as described in Section 8. On every two red leaders knot six strands of natural colored raffia in the following way: Place a strand under the two leaders, at right angles to them. Then proceed to tie the knot (Solomon's knot). Every knot must be pressed close to the brass ring, thus forming a symmetrical center for the bottom of the bag (See Fig. V). Between every two pairs of leaders we have twelve strands of natural colored raffia—six strands pointing to the left and six strands pointing to the right. Gather the twelve strands into one hand and tie together, using the first leader to the right and the first leader to the left for tying the Solomon knot (Fig. V). Treat the other leaders in this manner (Fig. IV, c).

The next step is an important one, for upon it depend the shaping of the bag. The two leaders, between two knots, naturally lie toward each other. They are tied together in an ordinary hard knot. To make the bottom of the bag flat, the leaders are tied so as to allow the work to lie flat. To make the bottom rounded, and later to draw the sides into shape, the leaders are drawn closer together. Tie all the leaders in this manner. Now the first half of the figure is finished (Fig. V, a).

Hold the leader which points to the right, in the right hand, over the bunch of strands. Take six strands from the knot on the right, and in their order, tie them in a hard knot, on to the leader held in the right hand, letting each strand come under the leader (d) (c). Take the other leader, which points to the left, and hold it in the left hand. Take

six strands from the knot on the left, and in their order tie them in hard knots, on to the leader held in the left hand (c) (d). Tie once around in this manner. The two leaders

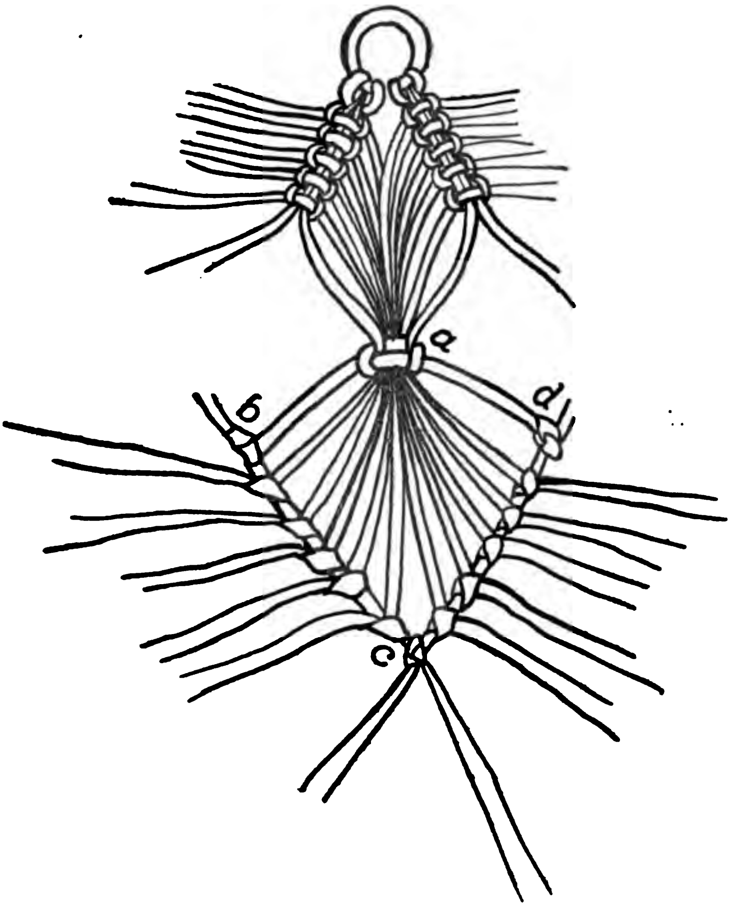


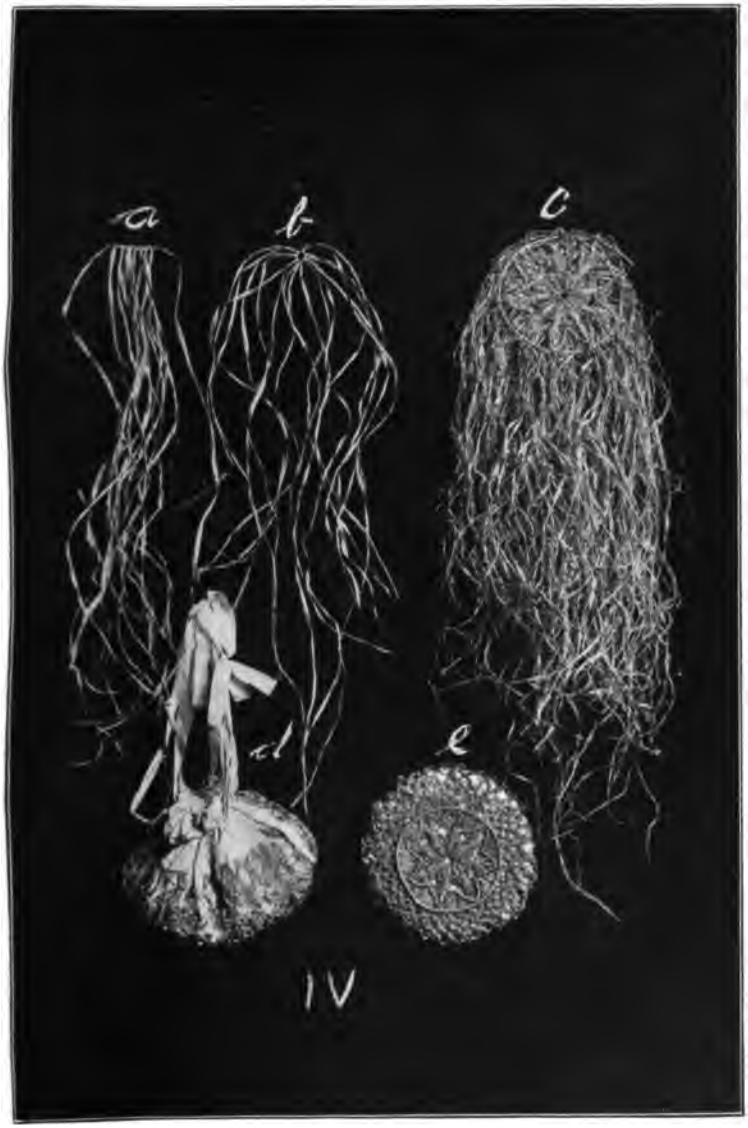
FIG. V. KNOTTED DESIGN FOR SEWING BAG

fall together at the bottom of this figure (c). The figure is now complete. Repeat the exercise until the desired shape and size are attained.

The bag may be finished in several ways: (1) The ends of the raffia may be braided and looped over to the inside, where they are fastened. (2) The ends along the edges of each scallop may be run each way from the upper point, passing through all the knots, and being cut off at the lower point of the scallop. (3) The ends may be run each way, through all the knots, to the upper point of the scallop, and tied in a small tassel (4). The edge, if finished without the tassel, may be bound by sewing over and over with narrow ribbon or raffia. Use a braided handle. A pretty lining adds to the beauty of the bag.

10. Handkerchief or Work Bag. Fig. IV (c) shows the bottom of a very attractive handkerchief or work bag. The exercise is begun as in (a) and (b). After the first row of points is completed, the ends are all tied to a piece of No. 3 reed, bent circular, as shown in Fig. IV (c). This is done by first tying the reed to the ends of the points of the leader (c). Each strand of raffia is tied with a double knot around the reed, drawing it from below just as the strands were knotted around the leader in Fig. IV. After the strands have all been knotted around the reed, begin to make Solomon knots and continue until the bag is as large as desired. The top may be finished by making rows of Solomon knots. Bend outward and fasten, making loops around the top. Cord or ribbon is drawn through the loops to close the bag, or the lining may be allowed to form a heading and the draw strings run through it, as in Fig. IV (d). Fig. IV (e) shows the bottom of the bag. By making the knots close together near the bottom, the lower part of the bag will have a more solid appearance than the upper portion, producing a pleasing effect.

11. Continuous Coil Basket. The material required is reeds and raffia. Soak a No. 2, 3, 4 or 5 reed in hot water until pliable. Dampened raffia makes the work more even and smoother. Thread a darning needle with the large end of the raffia. Scrape the reed flat, with a knife, 1½ inches from the end. Hold the reed in the left hand, and wind the



LADY'S HANDKERCHIEF BAG

Woven from raffia

thread, carefully, around the scraped portion. Wind toward the point. Shape the covered end into a round coil and sew firmly through the center until the coil is securely fastened. See that the coil is well covered with raffia (Fig. VI). This

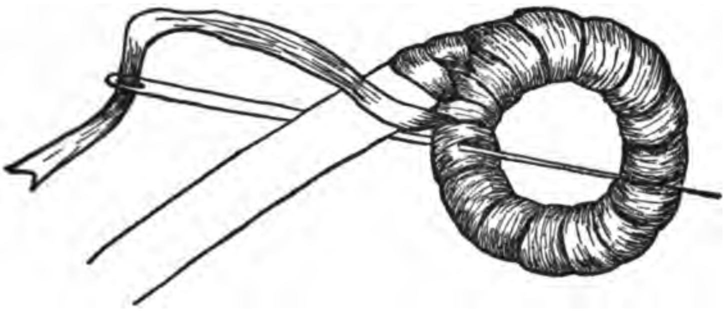


FIG. VI. COVERING A REED

is simply stitching over and over the one coil. Introduce a new thread by placing it along the reed, and working over it until the end is securely fastened. Thread the new strand into the middle and work the end of the old one until it is securely fastened.

To introduce color, proceed in the same manner as in introducing new threads. Do not cut the threads in changing from one color to another, but carry them along with the reed, and work over them. In filling out designs, stitches are not counted as would naturally be supposed. The design must be filled in solid, and may take more or less stitches, according to the size of the thread. A pattern of the design to be used may be cut from paper, and laid on the basket as the work progresses.

After the bottom of the basket has been made the desired size, begin shaping the side by holding the reed directly over the last coil, if straight sides are desired. If the basket is to flare, hold the reed and raffia to the outside of the last coil. If the basket is to grow smaller, hold the bunch of reeds and raffia to the inner edge of the last coil.

To splice the reed, scrape the ends to be spliced two inches from the points, and place them together, lapping one over the other, so that the size of one reed may be kept. Continue weaving, holding the ends together until they are securely fastened.

Finish the basket by scraping the reed to a point and finishing the coil off gradually. This basket may be made with a rope of raffia or an ordinary clothes line rope for the foundation.

12. Navajo Weave. (a) ROUND BASKETS. To commence a round basket, proceed as in Fig. VI. Bring the thread back between the coil and reed, and over the reed to the front, and back between the coil and reed. Bring the needle through to the front under the coil. The stitch is now complete (Fig. VIII). As the coil progresses, each stitch

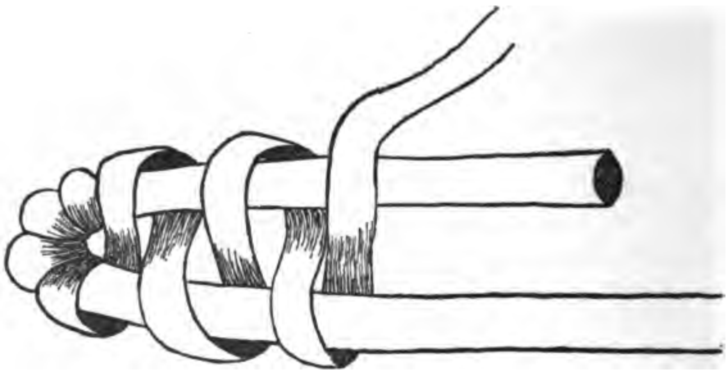


FIG. VIII. CLOSE WEAVE

is passed between two stitches of the coil beneath. For introducing new threads, color, design, splicing the reed and finishing, see Fig. VI. Fig. VII (d) shows the finished basket.

(b) OVAL BASKET. To commence an oval basket, measure off six or eight inches of the reed, and carefully bend it at this point. Hold in the left hand the two reeds, keeping the short end underneath the long one, and the bent end to the right. Commence weaving by wrapping the raffia

several times around the bent end. Use the Navajo stitch. Draw the thread firmly, and do not let the reeds spread apart.

(c) Needle Basket. This attractive and useful article may be made by weaving over a No. 1 reed a small Navajo basket. Make a small cushion to fit the basket. Fasten the cushion in place with threads of raffia.

13. Mariposa Weave. To commence an oval basket, follow the instructions in Fig. VI. After the bent end is smoothly covered, bring the thread over the long reed from the back down between the two reeds, around the short reed, and down between the two reeds again. Bring the thread

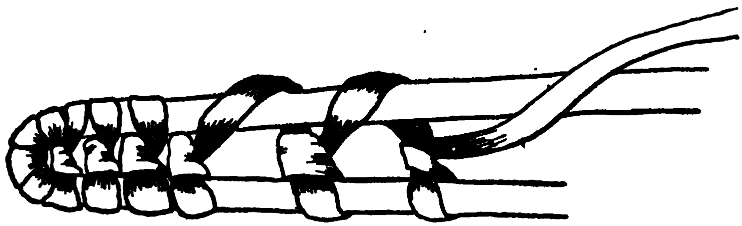


FIG. IX. MARIPOSA WEAVE

up between the two reeds at the right of the stitch, and down between the two reeds at the left of the stitch. This completes the stitch. Both reeds (Fig. IX) are wound toward you. This is sometimes called the *open work stitch*. For introducing new threads, color, design, splicing the reed and finishing, see Fig. VI.

Fig. VII (b) shows the completed basket.

14. Lazy Squaw Weave. (a) Small Coil. To commence a round basket follow the instructions given in Fig. VI. This is a long and a short stitch. Hold the coil in the left hand. Wrap the raffia toward you and around the reed, then over the reed again and down through the center of the coil. This gives the long stitch, while wrapping the reed once gives the short stitch (Fig. X). In the Lazy Squaw weave the thread is wound toward you, just the opposite of the winding in the Navajo weave. For introducing new

threads, color, design, splicing the reeds and finishing, see Fig. VI. Fig. VII (e) shows the finished basket.

(b) LARGE COIL. To commence the basket, follow the instructions given in Fig. VI, using a No. 2 reed. Gradually introduce three more No. 2 reeds and eight or ten strands of

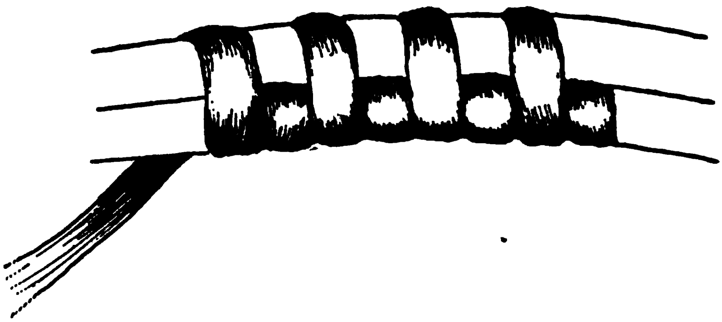
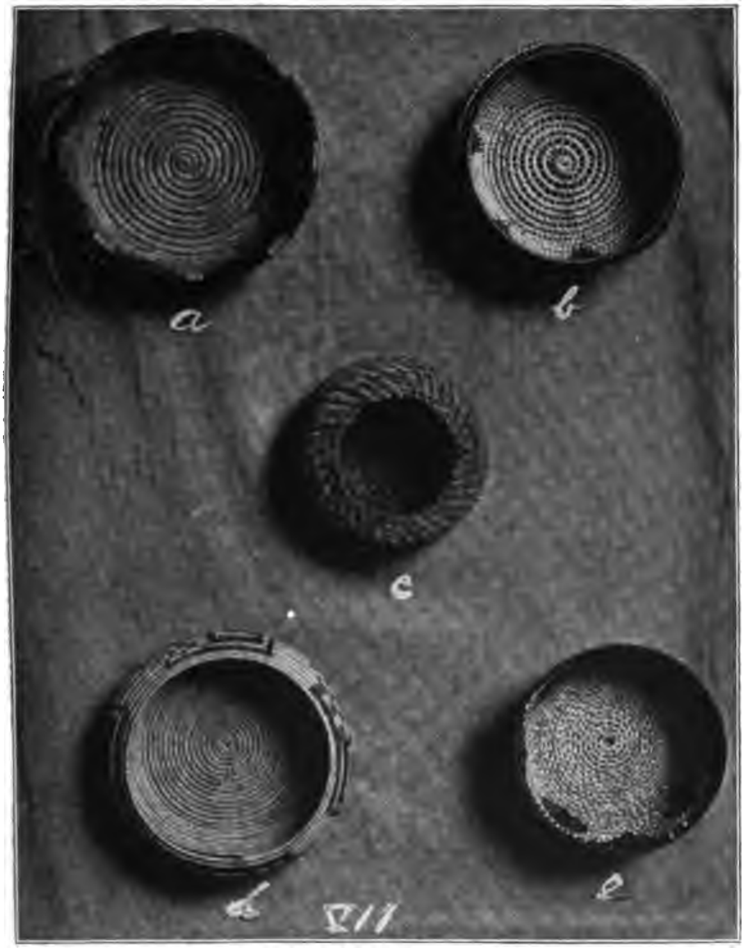


FIG. X. LONG AND SHORT STITCH

raffia. Wind the coil three or four times in making the short stitch, then down through the coil once, for the long stitch. Keep the coil a uniform size by introducing new reeds and strands of raffia. This basket is often made with coil of raffia without the reed. For introducing new threads, color, design, splicing the reeds and finishing, see Fig. VI.

(c) CROCHET STITCH. To commence this basket, follow the directions given in Section 7, using a No. 2 reed. The coil is divided into eight equal parts by the long stitch of the Lazy Squaw weave. In the second round, the long stitch falls directly upon the long stitch of the first round. Working from you, as in the Lazy Squaw weave, split the long stitch in the first coil. The ribs formed by these split stitches must radiate evenly from the center of the basket. To keep the basket firm, long stitches, forming new ribs, are introduced as the basket progresses. To introduce new threads, color, design, splicing the reed and finishing, see Fig. VI.

15. Pomo Bam Tush. Soak a No. 1 reed until pliable. Cut eight lengths. Take four of these reeds and lay them



INDIAN BASKETRY

(*a*) Continuous stitch; (*b*) Mariposa stitch; (*c* and *d*) Navaho stitch; (*e*) lazy squaw stitch.
These beautiful and useful articles can be made by any child in the intermediate and grammar grades. (*a*) shows the loose strands of raffia of which the basket is made.

parallel to each other. With a strand of raffia, weave over and under through the centers of the reeds, until you have a square of weaving. Make two of these sets of weaving. Place the two sets together, crossing them at right angles, and having the ends of the two weavers come together. Commence weaving around the center, using both threads, one thread passing over the reed while the other passes under the same reed. After weaving around four or five times, insert two extra reeds in each corner. Now begin radiating the reeds, making a complete circle. The weaving must be firm and close. To introduce new threads, weave the new threads along with the old ones for several inches. Then push the old thread on the inside of the basket. The ends of the threads are cut off after the basket is completed.

This basket is shaped over a form—a medium sized bowl is convenient. The bottom of the basket must be woven as large as the bottom of the bowl. Place the bowl on the woven bottom, and fasten securely by tying over the top of the bowl with extra threads of raffia. The weaving may now be continued, pressing the reeds close to the bowl. Two or more colors are attractive in this weave.

When the weaving is finished, cut the ends of the spokes a uniform length, about three inches, leaving the ends sharpened. Soak in warm water until very pliable. Carefully bend the end of the first spoke and push it down beside the second spoke. Bend the end of the second spoke and push it down beside the third. Continue in this manner until all the spokes are fastened.

PAPER AND CARDBOARD.

16. Value. Paper and cardboard afford an excellent means of working out or making practical much of the number work used in the intermediate and grammar grades. Some objection is occasionally made to this material because it is not substantial. This is not a serious objection. The first exercises are simply a preparation for more advanced problems later. Every child is able to use this material because it is

cheap. The paper comes in every shade of color and in various textures, and the choosing of these shades is in itself an excellent art training. Every model requires a drawing and the care and neatness necessary in this drawing afford a good means of discipline. The geometric figures require the most accurate drawing and construction. The decoration on these exercises is an important part of the problem, and forms the beginning of an art training that will be very valuable in the more advanced work in weaving, leather work, basketry and metal. This work, when proprely taught, affords excellent mental training and discipline.

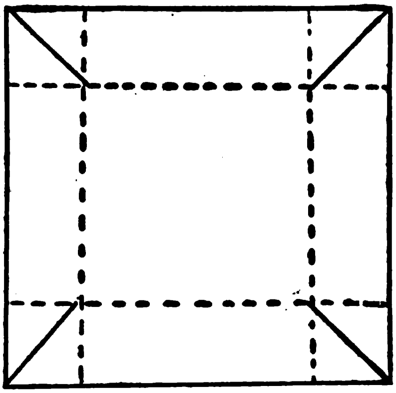


FIG. I (a) PLAN FOR CHRISTMAS BASKET

17. Baskets. The following are suggestions for Christmas, May or Easter baskets.

FIGURE I. Material: Light weight bristol board, drawing paper, or Prang special construction paper.

Draw a 5-inch square. Draw lines one inch from and parallel to the edges of the square, as shown in the figure. Draw the diagonals of the squares found in the corners of the pattern drawing. Cut all continuous lines. Score all dotted lines. To do this, place the ruler along all lines to be creased, and draw the back edge of one of the blades of the

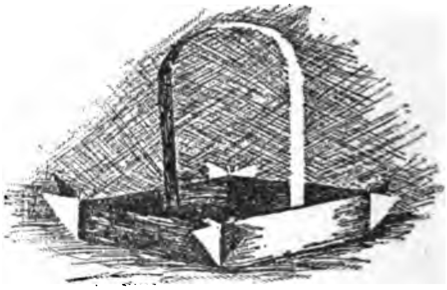


FIG. I (b) COMPLETED BASKET

scissors over these lines. Do not press hard enough to cut the paper. Before doing this scoring, compare your drawings with the figure to see that it is correct. Turn the triangles in the corners outward, and tie the corners with twine or narrow ribbon. Cut a handle 7 x ½ inches.

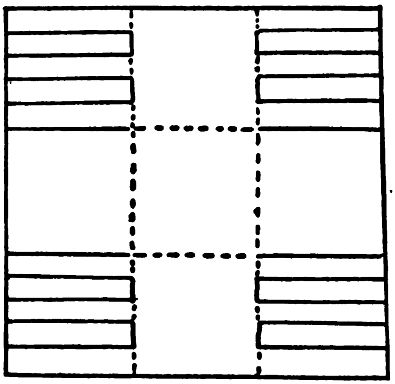


FIG. II (a) PLAN FOR EASTER BASKET

FIGURE II. Material: Drawing paper, light weight bristol board, or Prang special construction paper.

Draw a 6-inch square. Divide this into two-inch squares. Divide the squares in the corners in five parts. Study the figure before making these divisions. With young children this may be done free-hand. Cut all continuous lines, and score all dotted lines. Paste as shown in the finished basket. The center squares on the right and left sides turn upward and the strips formed by cutting the corner squares are pasted to these center squares.

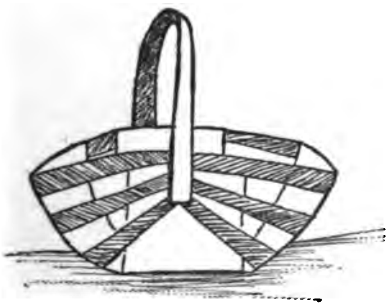


FIG. II (b) COMPLETED BASKET

FIGURE III. Material. The same material may be used as for the previous exercises.

Present a completed basket. What is the first drawing to be made in making the pattern drawing for this basket?

From the construction of previous baskets and boxes, the pupils should know that it is a rectangle. By careful questioning the teacher is often able to get the pupils to work out for themselves much that is ordinarily dictated,

thus giving the pupils no opportunity to think for themselves. Draw a rectangle 5¾ by 4¼ inches. Draw other lines within this rectangle 1¼ inches from and parallel to the edges of the rectangle. There is now a 1¼ inch square in each corner.

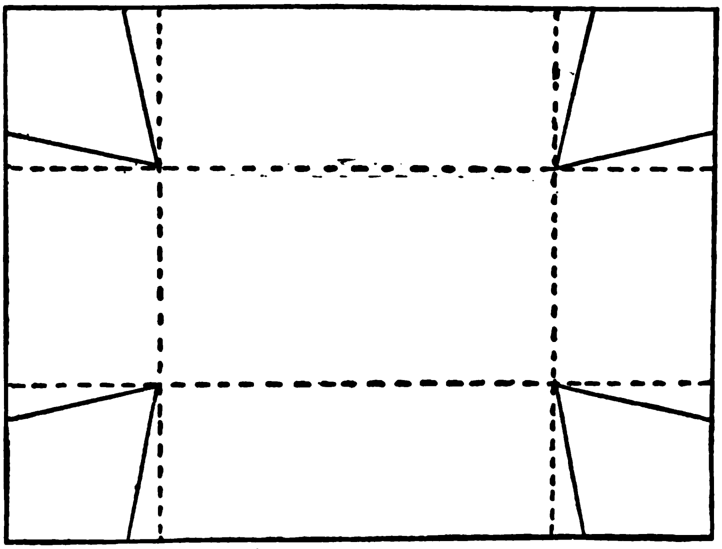


FIG. III (a) PLAN FOR FLOWER BASKET

The slanting straight lines within these small squares are ¼ inch from the outside corners. Study the figure. Cut all continuous lines and score dotted lines, which form the bottom of the basket.

FIG. III (b) COMPLETED BASKET

Cut a strip 12 inches long and ½ inch wide. This strip is pasted around the top to hold the upper edge of the basket together. Before beginning to paste the strip, mark it off into four parts, as this will tell exactly the part of the strip which is to be used along each edge. Begin to paste the strip at the middle of one side or end. By doing this, the seam will not come at a corner. Cut a handle 6 by ½ inches.

Figure IV. Material: Light weight bristol board, drawing paper, or Prang special construction paper.

Draw a 6-inch circle. (This means a circle measuring 3 inches from the center to the circumference.) Bisect the circumference of the circle vertically and horizontally by placing dots in the circumference. With each of these points as a center, draw a 2-inch circle (one inch from center to circumference). These circles cut the large one. Use these points of intersection as centers, and draw other 2-inch circles, as shown in the figure. Cut all continuous lines and fold into shape as shown in the completed basket. Tie at the corners with twine or ribbon.

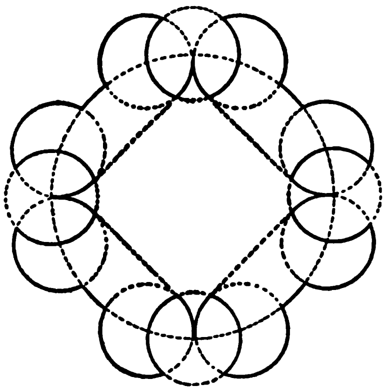


FIG. IV (a). PLAN FOR MAY BASKET

Figure V. This exercise is almost the same as Figure IV, only it is cut differently. The square drawn in the center is made by placing the ruler across the points where the middle circle bisects each of the others, or by connecting *a* and *b*, *c* and *d*, *e* and *f*, *g* and *h*. Study the figure carefully before making the drawing. Cut all continuous lines and fold into shape. See the drawing of the completed basket. Tie the corners.

FIG. IV (b). COMPLETED BASKET

18. Boxes. Since so many uses for boxes may be found in the primary and intermediate grades, directions for making

a few of the more simple ones are given. There are boxes for colored crayons, seed boxes, boxes for colored shoe-pegs and toothpicks, candy and valentine boxes.

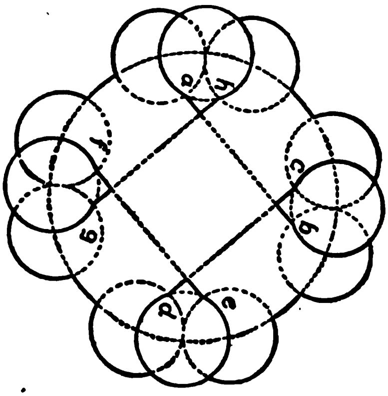


FIG. V (a) PLAN FOR MAY BASKET

SQUARE BOX. Material: The same as in the previous exercises. Figure VI shows the pattern and completed drawings for a 3-inch square box with cover attached. Draw a rectangle 9 by 5 inches. Draw lines within the rectangle 1 inch from and parallel to the edges of the rectangle. Draw parallel lines across the center, 1 inch apart, as shown in the drawing. Cut all continuous lines. Score the dotted lines. Turn the sides upward, and paste. Study the figure.

FIG. V (b) COMPLETED BASKET

RECTANGULAR BOX. Material: The same as in previous exercises. See figure VII. Draw a rectangle 9 by 7 inches. Draw lines parallel to and 1 inch from the edges of the rectangle. Draw parallel lines through the center, 1 inch apart, as in Fig. VI. Cut all continuous lines. Score all dotted lines. Turn upward and paste.

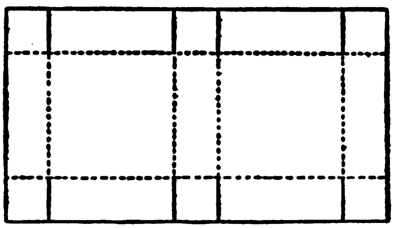


FIG. VI (a) PLAN FOR SQUARE BOX

TRIANGULAR BOX. Figure VIII. Material: The same as in the previous exercise. Draw a 7-inch square. Draw

lines 1 inch from and parallel to the edges of the square. Draw straight lines ¾ inch from the edges of the small squares in front, left and back, right corners, as shown in the figure. Connect with the ruler the points where the lines just drawn touch the inner lines, and draw diagonal lines as shown in the pattern.

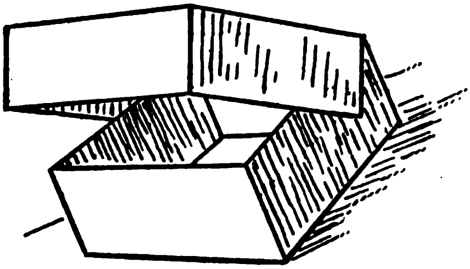


FIG. VI (b) COMPLETED BOX

Cut all continuous lines. Score all dotted lines; fold and paste.

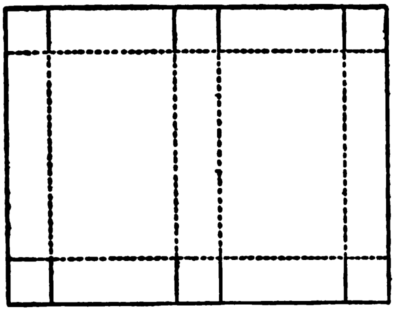


FIG. VII (a) . PLAN FOR RECTANGULAR BOX

HEXAGONAL BOX. Figure IX shows a pattern drawing for a hexagonal box, with cover attached. Draw a 3-inch circle within a 5-inch circle, using the same center. With 1½ inches on the circle maker, mark off six points in the circumference of the small circle. Connect these points with straight lines. From each point draw a straight line perpendicular to the edges of the hexagon. With *a* and *b* as centers, and a distance equal to *ab* on the circle maker, draw two arcs which intersect at *c*. With *c* as a center, draw two other circles the same size as the ones just drawn. Proceed to construct the cover on the same plan as the box. When cut and pasted, the result is a hexagonal box with cover attached.

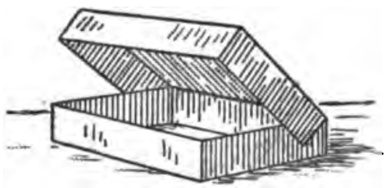


FIG. VII (b) COMPLETED BOX

19. Envelope Folio. Material: Heavy cover paper. Draw a rectangle 17¾ x 11½ inches. Place the long edge of the rectangle parallel with the front edge of the desk. Draw a line parallel to and 5 inches from the left edge of the rectangle. Draw a line parallel to and 4¼ inches from the right edge. Draw other lines parallel to and 2 inches from front and back edges. Draw slanting lines as shown in the pattern, Fig. X, from points on outside edges. 1 inch from corners, to inside corners. Draw a tongue, as shown, at right. On the opposite side cut slits into which the tongue may be drawn. This makes a very interesting folio, in which language papers or drawings may be kept.

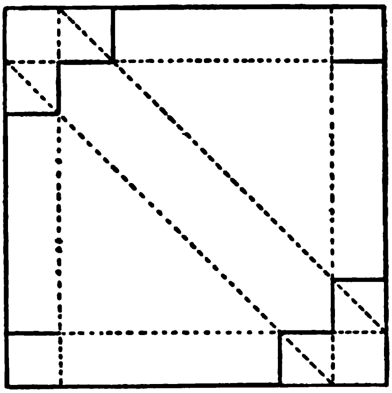


FIG. VIII (a) PLAN FOR TRIANGULAR BOX

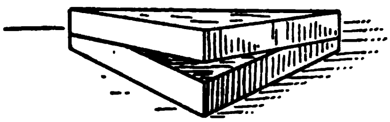


FIG. VIII (b) COMPLETED BOX

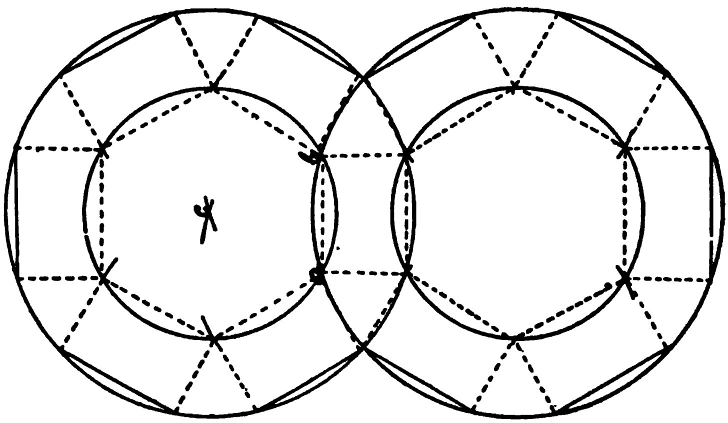


FIG. IX. PLAN FOR HEXAGONAL BOX

20. Lantern. Figures XI and XII show drawings for a lantern. Material: Jute or straw board.

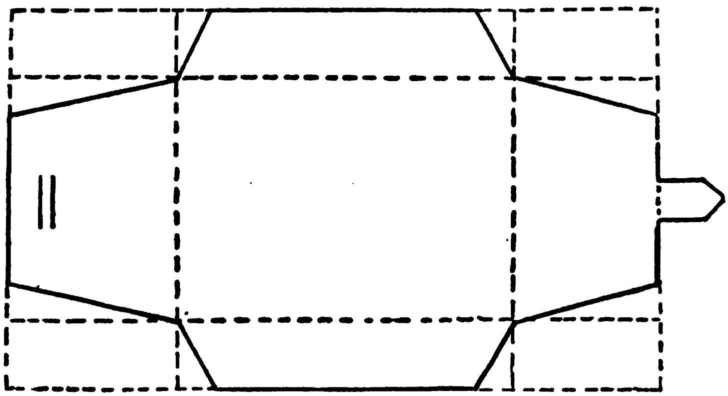


FIG. X. ENVELOPE

Draw a rectangle 6 x 5 inches. Place the short edge parallel with the front edge of the desk. Draw slanting lines from points 1 inch from the front corners to the back corners, as shown in Fig. XI. Bisect the back edge, and 2¾ inches from this point of bisection place a dot at the point marked "a". Connect the back corners by slanting lines to this point.

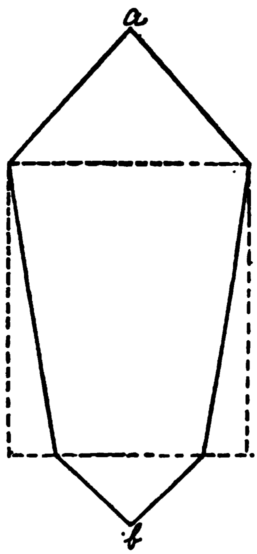


FIG. XI. DRAWING FOR LANTERN

Bisect the front edge of the rectangle and place a point at "b", 1½ inches from the point of bisection. Connect "b" with slanting lines drawn within the rectangle.

We now have a pattern for one side of the lantern. This when placed or repeated, as shown in Fig. XII, gives the complete drawing for the lantern.

By use of the shoemaker's punch, holes are placed as shown in the draw-

ing. Lace back and forth with a colored twine, and we have the finished electric lantern, as shown in Fig. XIII.

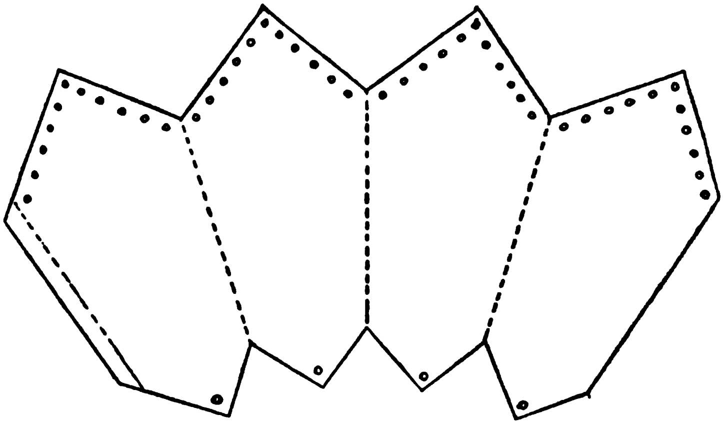


FIG. XII. PATTERN FOR LANTERN

A design is cut in each side and colored tissue paper is placed on the inside. Fig. XIII shows the design.

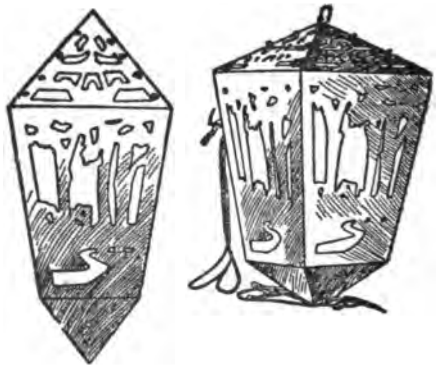


FIG. XIII. COMPLETED LANTERN

DYE STUFFS

21. Vegetable Dyes. (a) INDIAN DYES. When we come to the coloring of baskets or the materials of which they are made, we enter another field that has been only partially explored. We must form

our tastes from good models, and nothing better is known to art than the olden hues used in baskets made by the Indian tribes of the Southwest.

A visit to any museum where there is a collection of these Indian baskets will enable one to recognize the soft, rich, quiet Indian colors.

True Indian colors, used in basketry are few in number, red, green, black, cream, yellow, brown and occasionally blue; but there are many soft gradations of self-coloring—soft yellows, browns, greens, that are more harmonious than brighter colorings would be.

It is true that the "Indian dyes may be duller, that they do not run through such a lengthy, diverse and brilliant chromatic gamut as the white man's dyes, but the Indian dyes are permanent and they are so softened by the mellowing touch of time, as to gain with age an exquisite combination of color values, altogether inimitable."

Vegetable dyeing is a fascinating part of basketry. When one is interested he is led to make many new discoveries.

It is surprising how many beautiful dyes may be found in the fruits and blossoms of many plants.

The faded flowers of the purple iris are full of the purple liquid.

The Indian method of dyeing is as different from ours as is their choice of materials.

Sometimes they bury spruce root and other woody fibres in certain mineral springs or mud pools for weeks and months, and thus gain a beautiful chocolate color. In another tribe a pit is made, the material is smeared with charcoal paste, sprinkled with two inches of willow ashes, and the whole covered with loose, damp earth, and allowed to remain three or four days. Experience has taught the Indian that if it is left too long, the lye will eat the fibre and render it useless, and if taken out too soon the color will be brown instead of the desired glossy black.

Squaw grass, used by the Klickitas in their exquisite basketry, is naturally white, but is turned to yellow by being soaked a certain length of time in cold water, while a rich brown is obtained by using hot water.

Boiling mud from sulphur springs that abound on some of the reservations is used to color splints black.

Some berries are used for red, and the seed-case of the sunflower yields a dark rich purple.

These Indian methods of dyeing are crude and laborious, but the results are exquisitely beautiful and fadeless. So long as we seek by means of vegetable and mineral dyes rich, soft and enduring hues, it is perfectly legitimate to shorten and simplify the process and to employ any labor-saving device.

(b) Recipes for Dyeing Raffia and Rattan. (1) *Mordant.* A useful mordant for most vegetable dyes is made from three ounces

of alum dissolved in one quart of water. Soak the raffia, rattan or grass, etc., in the mordant over night and drain before putting the material into the dye proper. All material must be thoroughly cleaned before dyeing.

(2) *Blue.* Indigo is a pure and enduring dark blue, but demands so much attention and labor that it is not a favorite with amateur dyers. An indigo dye-pot, once started, may be used almost indefinitely by adding more dye as the old is used.

Take eight parts of indigo (paste), three and one-half parts of bran, and twelve parts of potash or lye, with sufficient water. Keep this solution at about 95 degrees for a week to ferment. If it is slippery it needs more bran and lye. Use the latter, one part saturated solution to nine parts of water. This bath will have a greenish color, not at all like indigo.

The material to be dyed is placed in the warm dye, allowed to remain from one to several hours, according to its absorbent capacity, is then hung in the air, in a breeze if possible, is again put into the dye and the process repeated until desired shade of dark blue is obtained.

No alum or mordant is used with indigo. Get the indigo paste at some dye house.

(3) *Yellow.* (a) Soak raffia or rattan in alum mordant over night.

Soak fustic chips over night; in the morning boil for ten or fifteen minutes in the same water. Strain. Place the material in the strained solution, letting it remain until the desired shade is obtained. If the chips are boiled too long a dull olive color is obtained. It is for this reason the chips are removed after boiling ten or fifteen minutes.

(b) Make a solution with green peach leaves. No mordant is used.

(c) Make a solution with bark from the white oak tree. No mordant is used.

(d) A common weed, in temperate climes growing in fence corners, and much abhorred by farmers for its disastrous effects upon stock when it gets mingled with hay, is the sneeze-weed. This, as well as many yellow composite blossoms, will give a pure fadeless yellow, when made into a strong tea. Use an alum mordant.

(4) *Scarlet.* Mordant the material with six parts of stannous chloride crystals to four parts of cream of tartar. Dye with cochineal which has been boiled and strained, until the desired color is obtained.

(5) *Red Orange.* Cochineal added to the fustic solution for yellow gives a dull red orange.

(6) *Orange from Annatto.* A bright orange is made from annatto. A short time before it is required for use it is dissolved by boiling

it with a solution of carbonate of soda (washing soda) for twenty minutes. Mordant the material with stannous chloride (or tin crystals), which dissolve in a small quantity of water, and dye.

A bright red orange is obtained by using broom sedge dye first. Drain and dry, then color with madder root.

(7) *Red.* Wash the material and soak in an alum mordant over night. Make a solution with hypernic chips. Boil for ten or fifteen minutes the following morning and strain. Place the material to be dyed in the strained solution, leaving it until the desired shade is obtained.

(8) *Indian Red.* A fine Indian red may be obtained by using extract of sumac.

Use an alum mordant.

(9) *Black.* A good black may be obtained by boiling logwood chips in sufficient water to cover them, for fifteen or twenty minutes. Add sufficient water to cover the material to be dyed. After boiling fifteen minutes, drop in a few lumps of copperas. When the desired black is obtained remove the material.

Sometimes the raffia is soaked in a solution composed of fifty parts of logwood and ten parts of fustic for one-half hour. The raffia is then removed and four parts of copperas added. The material is again returned and allowed to remain for fifteen minutes. This gives a good black.

(10) *Purple.* Soak the material in an alum mordant. Place in an extract of logwood, which is obtained by boiling the chips.

If a bluer purple is desired, add a little ammonia, baking soda or baking powder.

(11) *Green.* To color green use three parts of yellow and eight parts of blue.

Experience will show the worker that many gradations of color may be obtained by allowing the material to remain a longer or shorter time in the dye-bath.

Different shades of green may be obtained by changing the proportions above mentioned.

(12) *Brown.* The shucks of the butternut are used in dyeing a beautiful shade of brown.

Soak the shucks several days and then boil them for about twenty minutes. Strain, add sufficient water to cover the material. Remove the material when the desired shade is obtained. No mordant is necessary.

(13) *Brown from Walnut.* Treat the shucks of the walnut the same as those of the butternut.

A very good brown may be obtained from the bark of the walnut root. No mordant is necessary.

(14) *Brown from Logwood.* Cover the logwood chips with water

and boil ten or fifteen minutes. Strain, add sufficient water to cover material and boil for another twenty minutes. No mordant is necessary.

(15) *Brown from Hypernic.* A seal brown may be obtained from the chips of hypernic, the process being the same as in the use of the logwood. No mordant is necessary.

(16) *Olive.* To obtain a soft olive, dye first with the brown sedge, wash, drain, and then dye in indigo until the desired shade is obtained. Use an alum mordant.

Another olive may be obtained by mixing a pale purple with green.

(17) *Red.* The bark of the red oak makes a very fine red in coloring raffia, tilo and reed. A lump of lime about the size of a base-ball, dissolved in about five gallons of water, makes a very good mordant. The material is first dipped in the lime water and then placed in the oak solution. To extract all the color from the bark, boil thoroughly for about twenty minutes before placing the material to be dyed in the solution.

(18) *Yellow.* A very good yellow may be had from the blossoms of the golden-rod.

(19) *Green.* Tomato leaves and nasturtium leaves make a good green.

(c) General Suggestions. There are many other simple recipes for dyeing, but those given will be found sufficient for the beginner. Experimenting will teach the dyer that different materials take the dye in different times; thus, raffia requires only one-half the time that must be given to rattan.

To gain a certain hue, the material must be frequently lifted with two sticks and examined. It must be turned over and over, so all parts may be evenly submerged in the dye.

All materials must be thoroughly rinsed after being removed from the dye, and slowly dried in the open air.

The soap-weed or yucca, which is so invaluable to the basket-maker of California and the Southwest, yields four distinct hues that again merge into each other, forming most exquisite transitions of color. There is the ivory white of the heart of the plant, running to the dark olive green of the outer circle of the mature leaves. The Indian woman carefully separates these colors when she strips the leaves and hangs each color bunch by itself from the rafters of her house. Yucca is frequently colored red or brown. Sometimes plants are bleached to obtain white.

In some plants the two sides of the leaf will yield different colors.

Using undyed materials, the amerind produces a black effect with the ripe, peeled pods of the martynia, a dark brown with the stems of the maiden-hair fern, and a bright red with the roots of the yucca.

The teacher of rural schools will find this problem of vegetable dyes a very interesting one.

22. Aniline Dyes. The market is full of aniline dyes of various brands. All are good, but perhaps the one most conveniently used is the brand called the Easy Dye. It comes in tubes and may be used with cold water. The Easy Dye is furnished by the School Arts Supply Company, Lockport, Illinois. A little booklet is furnished free of charge, giving full directions as to its use.

TEST QUESTIONS

1. Make five statements in favor of paper and cardboard construction.
2. Give the commercial names of three different papers or cardboards suitable for construction.
3. What is reed? Where does it come from?
4. Give the names of two Indian baskets, and make drawings to illustrate stitches used.
5. What is meant by vegetable dyes? Name five local vegetable dyes.
6. Name four imported vegetable dyes.
7. How did the Indians secure their colored materials for basketry?
8. Make a drawing to show the way a reed basket is begun.
9. In making a small reed work-basket, state the size of reed you would use. Name three different weaves.
10. What is tilo? Where does it come from?

LESSON NINETEEN

DRAWING

INTRODUCTION

1. Aim of the Course. The aim of the following lessons in drawing is to inculcate a larger appreciation of the beautiful in nature and art, to develop the power to see beauty in commonplace things, to assist in bringing about an era of better taste in the selection of the objects which surround us, and to develop skill of hand in transforming raw materials into objects of use and beauty.

It is hoped, through a course in public school art, ultimately to improve the environment of the school and home, and eventually to bring about a greater interest in civic beauty, thereby increasing the pleasure of living.

2. Arrangement of Plan. The plan here given is by months, covering the work for the intermediate and grammar grades, from fourth to eighth, inclusive.

If the course is being used in an ungraded school, type lessons may be chosen which will carry out the spirit of the plan. A general outline of the subjects treated during the year is given under the heading *Plan of Work.*

3. Materials; Use and Care. The work, to be carried out most effectively, is dependent upon the selection and proper use of both nature and art materials. The nature materials will be considered under *Nature Study and Expression.*

The art materials consist of paper, pencils, crayons, outfit for water color work, rulers and paste.

(a) PAPER. The paper used for work in drawing and painting is an inexpensive manila, cut any size, but usually sold in two sizes, 6 x 9 and 9 x 12 inches.

Cream-tinted paper is preferred to white paper for work in water color, as the white dries too rapidly and because the white tone is too cold to obtain good color effects. The

white paper is the best for pencil work, but the inexpensive, cream-tinted paper may be used very effectively for both pencil and color.

Colored paper for mounting and construction work, in neutral tones of brown, green and gray, lends an additional interest to the work; but an inexpensive substitute may be had in bogus paper, of heavier weight than manila, and of a warm gray tone.

Rice paper, a thin, transparent paper for use in copying work, is a delightful medium, but it is, in a way, a luxury rather than a necessity.

Squared paper, a manila paper with lines printed to form half-inch or quarter-inch squares, is used in design work; but pupils can draw lines with a ruler and thereby save this expense.

Mounting cards, covered with gray bogus paper, of good weight for use in mounting exhibits of work, should be included in a list of supplies.

(b) PENCILS. A soft pencil is necessary for use in free-hand drawing; SS grade is a very good one. Any of the standard pencil manufacturers make good pencils for use in drawing—Dixon, Eagle or Prang.

Care of Pencils. The pencil should be sharpened to a blunt point and rubbed down on paper to make the best point for drawing. The drawing pencil should not be used for writing, but kept in cases made for the purpose, or by the children at their seats, in cases made for all their art materials. If pencils are kept by the teacher, each pencil should be marked with the owner's name, and should always be used exclusively by the owner, for sanitary reasons.

(c) CRAYONS. Colored crayons have become almost as universal a medium as the pencil, and, in the absence of water color, are a substitute for that medium. If but one medium can be obtained, a box of colored crayons is recommended as the best medium to purchase. A box containing eight colors—red, orange, yellow, green, blue, violet,

brown and black—is manufactured by several reliable firms, whose addresses are given under the heading *Supply Houses.*

(d) WATER COLORS. The use of color in connection with art study is indispensable. Surrounded by a world of beauty in color, one can only inadequately express form without the use of color. The three-color box, containing red, yellow and blue, with black added, is the most acceptable for school use. The colors may be purchased separately at three cents per cake.

(e) BRUSHES. A No. 3 sable brush, costing seven cents, has been found the most practical for general use in school work. A Japanese brush for line work is very convenient and inexpensive, but the sable can be substituted.

(f) WATER COLOR PAN. This may be purchased at slight expense. It is a small, black, japanned tin, with enamel lining. Tops of tin cans or fruit jars may be made to serve as substitutes.

(g) GENERAL CARE OF MATERIALS. Most of the materials needed in art lessons can be cared for by the individual pupil by placing in his desk, in a box or cloth case made especially for the purpose, everything belonging to one child. Materials furnished by the school, such as paper, should be passed out at each recitation.

4. Supplies and Supply Houses. The art materials enumerated, as well as many others, including drawing textbooks for pupils' use, and teachers' manuals, may be obtained at the following supply houses:

Prang Educational Company, D. C. Heath & Co., and Scott, Foresman & Co., all of 378 Wabash Avenue, Chicago; Atkinson, Mentzer & Grover, 223 Washington Street, Chicago; Joseph Dixon Crucible Co., 98 Jackson Boulevard, Chicago; Milton Bradley & Co., Boston, Mass.; Devoe & Raynolds Co., 176 Randolph Street, Chicago, and the Thomas Charles Company, 80 Wabash Avenue, Chicago.

It is suggested that teachers send to these firms for catalogues of materials and price lists.

PLAN OF WORK

5. Introductory. The work is so planned that the portion for each month is arranged and explained in detail under its proper heading. The work can be adapted to the needs of either intermediate or grammar grades by selecting simpler or more complex subjects, and this selection will depend quite largely upon their previous training. In schools where drawing has not previously been taught, the teacher will need to begin with simple subjects in all grades.

In order that each teacher may understand clearly all the principles explained in these lessons, it is absolutely necessary that she perform, herself, all the work indicated. She should work out with great care each direction given, for if she does not understand each step to be taken in making a drawing, she will be unable to give the clear, specific directions to children which will enable them to make correct drawings. After completing each lesson, practice drawing many simple objects based upon the principles discussed in the text. If the first results are not satisfactory, do not be discouraged. The old adage that "practice makes perfect" is doubly true in drawing. Practice persistently, and, after completing a drawing, examine it to see wherein it could be improved. Occasionally compare the work with an illustration of some similar study given in the text. Then try again. By working this way, one will surely succeed.

After completing the lesson for each month, prepare the work required in the *Test*, and send to the School. The drawings should all be made on regular drawing paper.

6. September. The work for September includes the study of various nature materials—grasses, weeds and flowers—in different mediums. If the work is being adapted to the needs of the intermediate grades, or to children in the grammar grades who have had little or no experience, care should be exercised in choosing the simpler subjects, such as the common foxtail, timothy, millet or cat-tail, in the grass family; among the weeds, the milkweed, jimson weed, etc., would make large, simple subjects, while among

the flowers the brown-eyed Susan, cosmos, sunflower and other single flowers would be the ones to select.

The more complex forms—oats, wheat and rye, among the grains, and the thistle and field flowers—could be chosen for the grammar grades.

7. October. In October the various grades might be assigned the study of a few trees for special consideration, again choosing the simpler ones for lower grades, as maple, poplar, elm, oak, apple, evergreen, beech, sycamore, birch, locust, in the order named.

The October landscape may be made as simple or as complex as the ability of pupils suggests. The range may extend from flat washes, to represent sky, ground and distant trees, to a special study of clouds and fields, and trees in the foreground with their wealth of color.

8. November. The work in November includes the study of seed pods, vegetables and landscapes, which may be adapted to the ability of any grade. Choose the larger forms in seed caskets and vegetables, and a single bare tree in the landscape, for the younger pupils; more complex forms, such as a branch of oak, with acorns and a chestnut burr, may be assigned the older pupils. The study of the November landscape may include a group of trees, or trees and a house, with a road or path in perspective. Use the landscape, with some appropriate nature quotation, in the upper grades. The text appropriate for Thanksgiving is a good upper grade problem, while the "Mayflower" would be simple enough for the intermediate grades.

9. December. The construction work in December should be planned with reference to the ability of the children. Box making, with simple decorations, would be a good problem for fourth and fifth grades, while basket making would be better adapted to the grammar grades.

If the school is ungraded, the teacher may give box making to all grades, varying the problem by allowing the upper grades to make the larger box, where the decoration becomes a more important feature.

The exercises on Christmas cards, or texts, may be made simple or elaborate, as the teacher plans.

10. January. If the pupils are familiar with the principles of cylindrical perspective, they can carry their work in object drawing to more difficult objects, which have handles, spouts, etc. The studies may include the grouping of several objects, or a still life object and some fruit or vegetables grouped together.

The effects of dark and light may be expressed in pencil painting, in upper grades, while the crayon work will be better adapted to the lower grades.

11. February. The work in rectangular perspective, in February, may be made simple enough if it is introduced by giving observation lessons, having the pupils express what they see, without too much discussion of principles. Use single boxes and books in the lower grades; the group of objects can be used for more complex problems for the upper grades.

12. March. The outline for March provides for the continuation of object drawing for grades sufficiently advanced in the work to make it interesting, and at this point the study of the figure is introduced. Animal and nature work may be continued for the whole month.

13. April. The nature subjects in April will include plants, birds and insects, chosen with due regard to the ability of the children to express them, and also with regard to the choice of the medium used in expression. Colored crayons, for instance, are an easier medium to use than water colors, and the study of the form only, expressed in outline with the pencil, is the simplest of all.

14. May. Nature studies are to be continued. Landscapes in simple wash effects may be introduced into the intermediate grades, and the higher grades can adapt the landscape or flower forms to decorative purposes, illustrating nature booklets and other articles to which the designs can be appropriately applied.

15. June. The closing work of the year should include a further application of the problems of decoration from

nature motifs, and from the various suggestions given throughout the year. Suitable problems may be chosen to meet the needs of any of the several grades, by allowing the lower grades to use the simplest nature subjects in their designs.

16. Summary.[1] The work of the year is planned to use the interesting material of each season, and the teacher should at all times look for the many opportunities to correlate the drawing with all the other school subjects. Drawing should become an illuminating means of making all other thought more easily comprehended, appealing to the sense of sight, through which much of our knowledge comes.

NATURE STUDY AND EXPRESSION

17. An Appreciation of Nature. Do you know the best way to interest children in nature and to create a love for representing nature's forms? Have you ever tried the plan of going on a nature tramp with the children, and enjoying with them the beauties of nature? The trophies you will find on such a walk will serve as interesting material for both nature and art study for several lessons. The different varieties of grasses, including the grains, the wild flowers, the pretty weeds, including the thistle, jimson weed, teasel, curly dock and others; the trees, the panorama of sky and ground, and the insect world are all marvelously interesting when we become intimately acquainted with them

SEPTEMBER[2]

September waves her golden-rod
Along the lanes and hollows,
And saunters down the sunny fields
A-playing with the swallows.

18. First Week. (a) ARRANGING FLOWERS IN VASES. The nature material which you have gathered will serve admirably to decorate the schoolroom, and will, at the same

[1] The work as outlined in Sections 6-15 is the regular course given to the students in the Western State Normal School, Kalamazoo, Michigan, and most of the illustrations in this lesson have been made by students in regular class work. The course in general has also been given to the children in the Training School.

[2] Consult Section 6, page 269.

time, afford a valuable lesson in flower arrangement. Ask the children to bring from home some common crocks, fruit jars, and large-necked bottles to use as vases, and then assist the children in choosing the nature material most suitable for the different receptacles, or ask the children to assist you. Do not arrange a great variety together; this gives a confused mass of forms and colors. If the flowers are large, like the sunflowers, golden glow, or field lilies, arrange those of only one kind together. Do not strip the leaves from them, but arrange them to give the most natural effect possible. Sometimes two kinds of flowers may be massed together so as to give a most pleasing effect, through contrast of form or color. The golden-rod with white or purple asters would be effective, or field lilies with white asters; but the golden-rod with the field lilies would not form a desirable group, because the color combination would not be so pleasing.

We may profit by the advice of John Ruskin, the eminent English art critic, who said, "Let us have nothing in our homes which we do not know to be useful, or believe to be beautiful." This will apply equally well to our school home.

After the children have beautified the schoolroom with these large and showy bouquets, it will stimulate their love for the beautiful to allow them to have on their desks a bottle containing grasses or a pretty flower. This will also do much toward cultivating an appreciation of beauty in nature.

(b) Flower Arrangement on Desks. Procure small sprays of flowers or pretty grasses. Provide each pupil with a sheet of drawing paper 6 x 9 inches in size.

Have the pupils arrange their flowers or grasses on the paper so that they will make a pretty study for use in drawing. Place one spray so it will look well (natural) in the space. Try placing it centrally, but not stiffly in the exact center. Do not place it slanting from corner to corner. If the stem grows erect, show the direction by placing it in this position. Then try placing two sprays together. Is

greater beauty obtained by placing one a little higher in the space than the other? Make the sprays look as if they were good friends; do not have them cross each other. In this way variety and unity, two essentials in a good work of art, may be obtained. After two sprays have been satisfactorily arranged, try placing three together. Arrange them to suggest the way nature arranged them while growing. Allow some of the children to show the arrangement they have made by drawing lines to represent the stems in an oblong space on the blackboard. Others may draw on a piece of drawing paper at their desks.

During the progress of this work, notice what difficulties the children have in handling their materials. Observe also the position of body, hands, arms and limbs while drawing. It is very essential that good habits of work be established at the beginning; therefore, a drill lesson should precede any definite work in drawing.

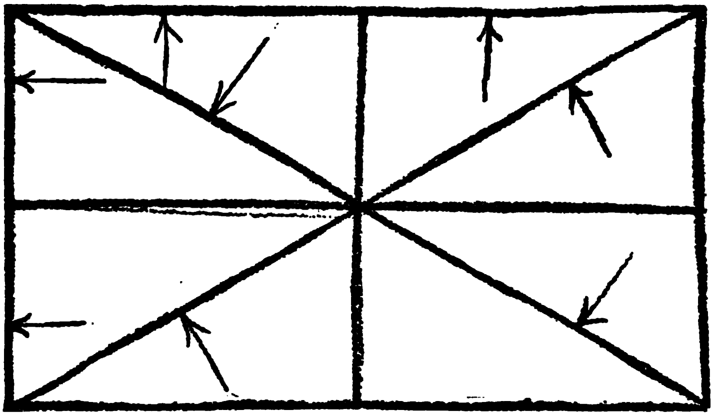
(c) LESSON ON PROPER POSITION. Supply each pupil with manila paper 6 x 9 inches, and a drawing pencil.

Previous to the lesson the pencils should have been sharpened, exposing a piece of lead between $\frac{1}{8}$ and $\frac{3}{16}$ of an inch in length. Do not use a pencil sharpener. A knife should be used to cut away the wood, and the lead should then be rubbed on a piece of manila paper or emery paper, making a rounded point. The lead should be so shaped that it will make a broad, soft line.

(1) *Holding the Pencil.* Take the pencil lightly between the thumb and first and second fingers, grasping it at about the center. The pencil should be held at right angles to the line to be drawn, as shown in the illustration. The arrow lines show the position of the pencil, and the heavy lines show those to be drawn. Move the pencil lightly across the paper from left to right. In drawing a horizontal line, the pencil should make a smaller angle with the paper than for other lines. Count for movement, "Over, back; over, back; over, ready, draw." See that the pupils follow directions. For vertical and oblique lines, the directions may be, "Down,

back; down, back; down, ready, draw." Do not change the direction of the pencil while making the movement.

(2) *Exercises*. Draw a page of horizontal lines about one inch apart, then draw vertical lines, making squares.



POSITION OF PENCIL

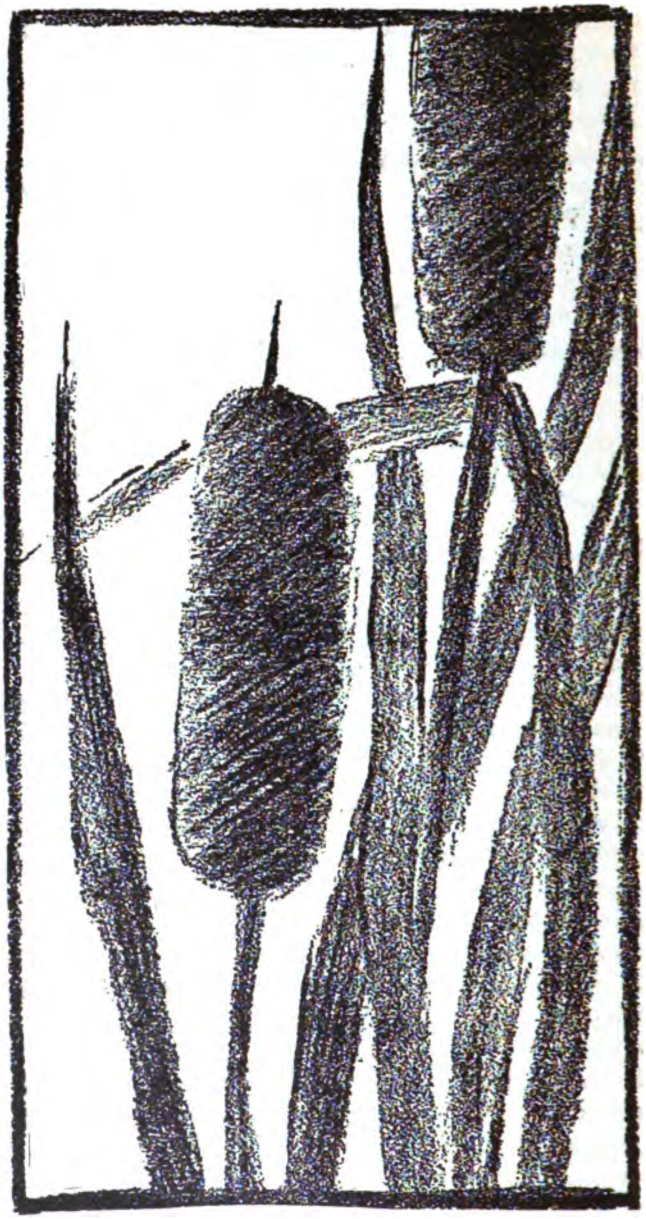
Turn the paper over and make oblique lines from corner to corner, and lines parallel to them, one inch apart.

In all exercises, see that the pencil is held in a position that makes a right angle with the line drawn. The line should be a broad, soft gray line of uniform width. (See illustration.)

In every lesson allow some children to draw at the board. The crayon should be short, from 1 to 1½ inches in length, and should be held between the thumb and first and second fingers, with the broad side to the board. The pupils should stand as far away from the board as possible, and work at arm's length. The position of the crayon should be the same as that of the pencil—at right angles to the line drawn.

(d) DEFINITIONS. Write all new terms on the board, and define them: horizontal, vertical, oblique, oblong, diameter, diagonal.

A *horizontal* line is a level line.



CAT-TAILS

A *vertical* line is an upright line.

An *oblique* line is a slanting line.

An *oblong* is a four-sided figure, longer than it is wide, and having its opposite sides equal and parallel.

A *diameter* is the length of a straight line through the center of an object, from side to side.

A *diagonal* is a line drawn from two corners not adjacent, and passing through the center of the object.

19. Second Week. GRASSES. Supply the pupils with pencils and paper 6 x 9.

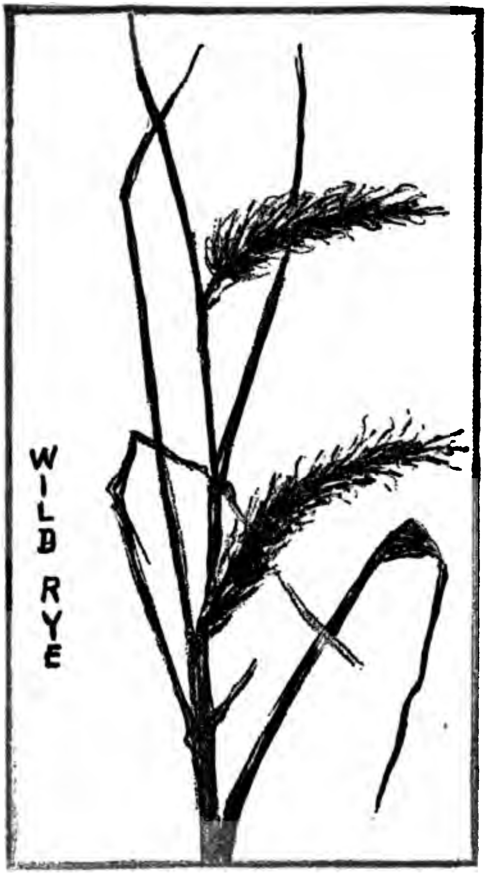
If you have enough grasses, put a few on each child's desk, and ask each one to make a pleasing arrangement, as in the previous lesson. There are numerous grasses that may serve well for this lesson, as the common foxtail, that grows on every roadside; millet, wheat, rye and barley also make interesting studies.

Direct the children to draw marginal lines on the paper which they have, making a good framing space for the picture. At the beginning of the exercise review the position at the desk, and manner of holding the pencil. Have the pupils sketch lightly to show the position of the stems in the space allowed for the picture, and then after studying the structure of a head of grass, have them try to show its appearance in their drawing.

Vary the work during the week by having different varieties of grasses. Use the grains, if possible. Cat-tails make a strong, simple subject. These may be fastened to a cardboard at the front of the room, where all the children can see them, or they may be left in a jar on the teacher's desk. Allow the children to make their own arrangement on the paper.

Colored crayons are a good medium to use in this study. Select the brown and green crayons that match the head and leaves, and use them as you do pencils. The long, slender heads and stems will suggest a long, panel-shaped paper, and the pupils should fold a 9 x 12 sheet so as to make a narrow panel.

If colored crayons cannot be provided, the pencil shading may show dark for the color of the brown head, and lighter strokes for stem and leaves. Make the strokes lengthwise through the leaves, to suggest the parallel-veined growth. The heads may be shown with slanting, or vertical strokes. Notice the difference in the light and shade side of the brown heads. Half close your eyes to simplify this effect. Arrange to have the light fall on the study from one side only. If there are cross lights, draw the shades at one side or back of the room. Have each pupil hold the study he has drawn as far away from him as possible, and compare the drawing with the subject, with half-closed eyes, and judge the general effect. If any of the studies are lighter than the subject, the pupil should go over the lines again, making them a little darker. See illustrations of grasses in pencil.



STUDY IN GRASSES

20. Third Week.

(a) Water Colors. Each pupil should have manila paper, a paint box, a brush, a small dish of water, and a soft

cloth. Place the painting materials at the upper right corner of the desk. Open the paint box, placing the cover toward you, for use as a palette. If the children have not used water colors before, ask them to look at and name the colors—red, yellow, blue, and possibly black. These three first-named colors are called *primary* colors, because from them other colors may be produced. Ask the children to experiment and see what colors they can make. Give the following directions:

(1) With your brush full of water, put a few drops on each cake of color to soften it.

(2) Put a few brushfuls of water in one of the little divisions in the cover.

(3) Make a green wash. First rub the brush lightly across the yellow cake, and mix the yellow in the water. Now add some blue, and watch the transformation; it produces green; adding more blue makes a darker, or bluer green. To lighten the color, add more water; more yellow added makes a yellow-green.

(4) Try on your paper the green wash you have made.[1] Fill the brush with the green wash. Commence at the top of the paper and sweep across the top from left to right. Then continue filling the brush, and with short, vertical strokes from left to right, cover the surface as rapidly as possible, insuring, by so doing, a smooth surface.

If a graded wash is desired, add a little more water to the wash, making it lighter as it comes to the bottom of the paper. Make about two green backgrounds, adding a touch of red in the second one, which will make a gray-green color, and make a graded wash. Allow these to dry and save them for the next lesson where a tinted background is needed.

(b) Weeds or Grasses. Tinted backgrounds and some pretty colored weeds, or grasses, that you have in your nature bouquets, form the materials for these studies.

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[1] Be sure to use manila paper for all work in water color, instead of white drawing paper, which gives a cold background and dries too rapidly, due to the amount of lime used in bleaching it.

Have you noticed that some of the weeds and grasses are already turning to brown or red autumnal colors? The curly dock or pig-weed will make a pretty study. The studies may be fastened on pasteboard easels, made by folding a long piece of cardboard and resting it like an easel. Place these on boards between the front desks. Pin the studies against some of the tinted backgrounds to study the effects. If the children do not have water colors, use the crayons to make a tinted background.

STUDY IN GRASSES

Use the color that matches the color of the weeds, making a light tone for the background. Draw the stem lines first, and notice any peculiarity of growth of the seed heads. Try to show the exact formation of the stem and fruit.

(c) Flower Painting. Any large single flower will be suitable for this exercise. Small sunflowers, the brown-eyed Susan, or the field lily are suggested. Express the study in water colors on manila paper.

Before trying to express the beauty of the flower in water

color, give a short lesson on handling the brush and color. Let the pupils try making the green you see in the leaves, mixing the colors in the brush by taking first a little yellow, then a little blue and a touch of red, to make the green less vivid. Each pupil should try the color he has made in his box top or palette. If the color is too dark, he should take another brushful of water, or touch the yellow cake, to make it more yellow. Now have the pupils touch their brushes to the paper to see if the color matches the leaves. The next step is painting the stems. The pupils should hold the brush in an upright position, and with the point make some firm, slender strokes to suggest stems. Then they should try pressing down on the brush gradually, to widen the stroke, making the stem wider. To make the leaves, fill the brush with color, hold it upright, and, commencing at the apex of the leaf, gradually press down on the brush, making a stroke as wide as the leaf. If this is not possible, make another stroke beside the first one, and continue

STUDY IN GRASSES

the strokes until the width and shape of the leaf are obtained.

After practicing to obtain the shape of stems and leaves, clean the brush on the cloth (not in the water), and mix the color for the flower. If the flower is orange color, use yellow and red together; if violet, use red and blue mixed. Experiment until the right color is obtained.

If the flower has separate petals, like the sunflower or the brown-eyed Susan, try making a petal with one stroke of the brush. Arrange the petals around the center, and notice that those projecting forward look fore-shortened; that is, shorter than those at the sides. Now paint the flower on another piece of paper. If your brush is full of the color of the flower, paint the flower first; or the stem may be painted in first, and leaves and flower added. Try to show the arrangement of the leaves on the stem. Are they alternate, opposite or in whorls? Also show the shape of the leaf, if it is turned, or foreshortened. If the leaves are slightly brownish, add more red to your yellow and blue.

Cautions. (1) Be sure to have the pupils clean their brushes on the cloth whenever they mix a new color for the flower.

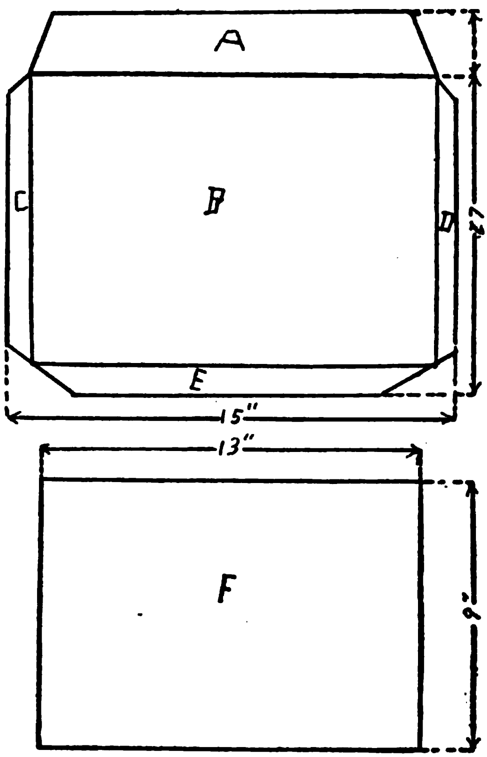
(2) Keep the water in the pans as clean as possible.

(3) Be careful not to mix mediums. Do all the work with water colors, not using a pencil to outline the forms first. Work directly in the flat mass effects with the brush and color. If pencil is used, try to show the contrast of color in the flower and leaves by pencil shading. See illustrations in pencil painting.

If the pupils have no water colors, colored crayon or pencil may be substituted, and the flower represented in either of these mediums.

21. Fourth Week. (a) ENVELOPE FOR DRAWINGS. The children should make envelopes in which to place their drawings. Use bogus paper for this problem in construction, or, if this cannot be obtained, use any tough wrapping paper, such as is found at the butcher shops or grocery stores. When

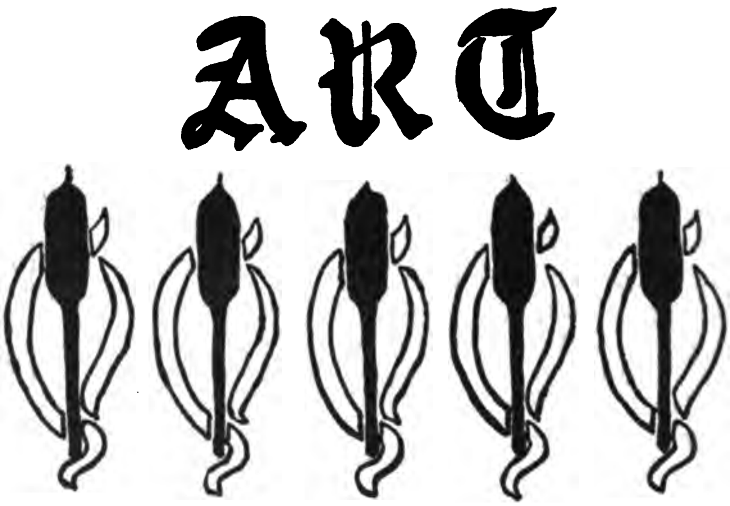
completed, the envelope should be 10 x 13 inches in size. This will allow sheets of 9 x 12 drawing paper to slip in and out easily. The full size of the sheet from which this may be cut should be 14 x 23 inches, or it may be made from two smaller pieces, one being 9 x 13, the other 14 x 15 inches. The larger piece allows for one-inch laps on three sides, and a three-inch lap on one side. Fold the larger piece (C, D and E) down to B; apply the paste to these laps, and paste the left, right and lower edges of F down on B. Fold the flap A after the envelope is pasted, and put under a weight to dry.



DRAWING FOR ENVELOPE

The envelopes may be decorated with some nature unit that the pupils have studied during the month. Some simple flower or leaf motif, or the cat-tail, will serve well for this purpose. If a flower form is chosen, select some simple flower, like the brown-eyed Susan, and with free brush strokes paint the center and the petals arranged around it. Work by opposites in representing the petals, placing one at the top, then one at the bottom, then at the left and the right sides, and filling in as many between as there is room for.

This design may be carried out in water colors, or colored crayons. The units may be arranged in a border at the bottom of the envelope, at the top and bottom, or on all four sides. (See illustration with cat-tail design.) Divide the space to be filled with the design into equal spaces, by drawing lightly with the pencil. Place the unit in the center



DESIGN FOR ART ENVELOPE

of these spaces, thus making a border around the envelope. The child's name may be printed on the envelope with the same color as is used in the design. If there are no water colors, colored crayons or ink may be used. Be careful not to use strong, gaudy colors in the design. Do not use the primary colors (red, blue or yellow), but the secondary colors, green or violet, may be used; or, best of all, mix all three colors together, making a brown.

(b) Tertiary Colors. Colors obtained by mixing all three colors are called *tertiary*. They are olive, citrine and russet. Citrine has more yellow than red and blue; olive has more blue than red and yellow; and russet has more red than blue and yellow.

(c) Mounting Drawings. Supply the pupils with 9 x 12 manila paper, scissors and paste.

Show the children how drawings and paintings can often be improved by cutting down the surplus background, putting a dark line at the edge of the study (paper), and mounting it on larger paper. If you have no scissors, the children may fold and crease their papers firmly and tear them, instead of cutting. If library paste is not at hand, make flour paste and use just a drop under each of the four corners of the study. Do not spread paste all over the back of the study.

(d) Exhibits. Make an exhibit of the best work done during the month. There is nothing which encourages children so much as to see their work on exhibition in comparison with that of others. Every schoolroom should have a bulletin board, or a space covered with burlap, where children's work may be exhibited. If nothing better can be devised, a piece of black mosquito netting can be hung and the drawings pinned on that. A more permanent exhibit may be made by pasting drawings on mounts of large gray cardboard. Mounts on tag-board may also be used. Do not paste too many drawings on each mount. Not more than three sheets of 9 x 12, or six sheets of 6 x 9 should be placed on a cardboard mount 22 x 28 inches. Fasten the mounts together, three deep, if arranged vertically, and four deep, if fastened horizontally, by tying them together with a twine or tape to match the cardboard. Punch holes with punch or nail, through which the cord is passed. These rows of mounts can be hung on the wall from the moulding.

(e) Illustrating Written Lessons. Some of the art work done during September may be used to illustrate nature compositions. Have the pupils write compositions on the subjects connected with your nature tramps, and illustrate them with their nature drawings and paintings. The composition and drawings may be fastened together, and enclosed within a cover of drawing paper, bogus paper or wrapping paper. Fasten the booklets together with paper fasteners,

or tie them together at the back with a cord that matches the cover.

Test. Make two pencil drawings of grasses from nature.

Make a design for an art envelope, using a nature form, but, in this instance, do not use cat-tails. Use ink or black water color.

OCTOBER

The world puts on its robes of glory now,
The very flowers are tingled with deeper dyes,
The waves are bluer, and the angels pitch
Their shining tents along the sunset skies.
—*Albert Leighton.*

22. Subjects for the Month. The beautiful month of October has long been a favorite theme for poet's pen and artist's brush. Whittier, Longfellow, Tennyson, Alfred Austin, Alice Cary, Helen Hunt Jackson, Lucy Larcom, and a host of others have voiced in song the beauties of October.

The French artists Rousseau and Diaz, and in America George Inness and the Hoosier group of artists have immortalized on canvas her glorious color. There are such riches from which to choose in nature, literature and art, that one has but to open his eyes and behold them on all sides. There should be daily observations of nature, and the written exercises in various branches should be freely illustrated with brush, crayon and pencil, in order most completely to reveal the beauties of this queen of months.

Some of the interesting themes for study and enjoyment are An Autumn Walk, An October Landscape, Trees in October, Flowers of Autumn, Fall Fruits, A Nutting Party, Harvest Time, Mother Nature's Treasure Caskets. Consult Section 7, page 270.

23. First Week. (a) TREES. Use manila paper and water colors.

Choose one of the trees the pupils have studied on their walks. Ask them to compare the shape and color of the maple, the oak and the elm, and note the points of difference. Which is the tall, graceful tree; the strong, sturdy one,

and the symmetrical one? What colors are in the foliage? Have the class paint the trees in their proper colors. Mix the color in the brush, and mass in the shape of the tree,

TREE STUDY

commencing in the center and working out to the edges, showing where the widest part is, also showing whether it is regular or irregular at the edges. After painting the foliage, the trunk should be added by mixing all three colors for the

gray color of the trunk. If branches are visible here and there, add a touch of this color to represent them. If you have no water colors, use pencil or crayon to represent the tree.

(b) OCTOBER LANDSCAPE. Water colors and 6 x 9 manila paper are the best materials for this exercise.

Study the color of the sky, the ground and the distant trees. Put a water wash over the surface of the paper. Represent October's bright blue weather in making the sky blue, bringing the color over the whole paper. What colors are seen in the fields now? Represent the ground space by mixing all three colors, to obtain the golden-brown or the gray-green. If the trees have changed color, try massing the color along the horizon to represent the distant trees.

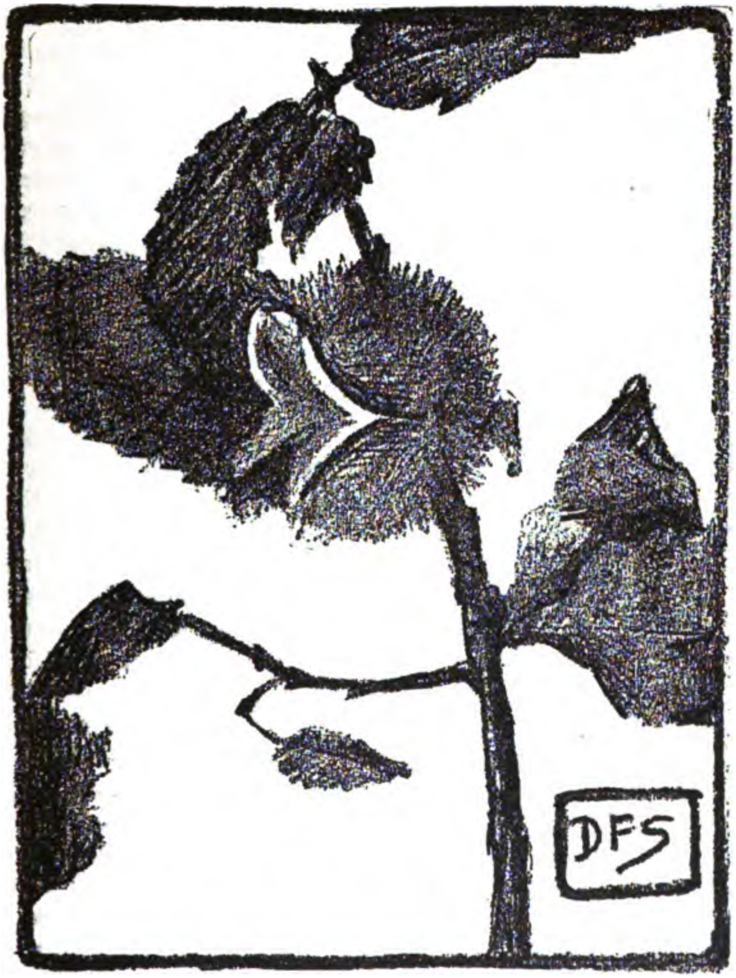
Pencil work in landscape study may be used in place of color. If the pencil is used, represent the ground with pencil strokes drawn close together, to show the darker mass compared with the sky, and then the trees may be represented in a still darker mass, using slanting strokes.

24. Second Week. AUTUMN FLOWERS, VINES OR WEEDS. Use the same materials as were required in the last exercise.

If the flowers still remain, use a simple arrangement of asters or golden-rod, and try massing in the color to show the form of the mass of flowers, leaves and stem. When flowers grow small and in bunches, the color may be applied in mass. Do not try to show too much detail.

Water color is the most suitable medium for flowers, while the weeds may be shown nicely in colored crayons. See illustrations. Try making a study of the curly dock or the teasel burr with the brown crayons. You should arrange the studies so that all the children may see them. To give an idea of the proportionate size of the subject, it is well to fasten the studies upon paper of the same size as that which the pupils are using. If the pencil is used, try to show the shape of the parts, and then by shading show the value of the color. The *value* of the color is its degree of

light or dark. If the color is light or dark, represent it by light or dark shading in pencil.



AN OPEN SEED VESSEL

25. Third Week. BRANCHES. Branches of fruit, as the apple or pear, a branch of oak with acorns, or a tomato vine

with its fruit, are suitable subjects for study. Use 6 x 9 manila paper and pencil.

Draw an enclosed space, or margin, about one inch from the edge of the paper. Study the arrangement of leaves and fruit on the branch, and sketch the stem to represent its position and character. Sketch the leaves lightly so as to show the arrangement, but do not try to represent them all, if there are many. Show the shape and size and arrangement of the fruit. Make a good outline drawing in this first lesson.

BRANCH OF AN APPLE TREE

Continue the study of the branch with pencil painting or water colors. If water colors are used, paint a gray-green background first, and, after that is dry, represent the color of leaves, stem and fruit. A perfectly flat wash may be used to represent this study without showing the effect of light and shade, and the study can be finished by painting a strong black line at the outline of each part when the color is dry, thus making a decorative study of it. See illustration of apple on branch.

If there is time, a pencil painting may be made of the same study, even if color has been used. If the pencil is used, make a light outline first, and then, with slanting

strokes massed close together, show the depth, or value, of the color of the study.

26. Fourth Week. (a) OCTOBER LANDSCAPES WITH TREES. Use water colors and 6 x 9 paper.

In our previous landscape study we represented the trees in the distance as massed in, in simple silhouette effect. In this lesson we wish to show the tree in the foreground; consequently, it will appear much larger and in brighter color. Paint the sky and ground as directed in the previous lesson

OCTOBER LANDSCAPE

on landscape. While this paper is drying, paint the tree you wish to represent on a dry piece of paper, representing the bright red and yellow of the maple, or birch, the russet color of the oak, or the dark green of the apple or elm. Try painting the tree on the original paper before it is quite dry, as this gives a softer effect to the edges, which suggests the haze of the atmosphere over everything. This is very important. See Color Plate One.

(b) ILLUSTRATING POEMS. Another lesson might be given by reading a descriptive poem to the children, and asking them to illustrate it with color. The water color is preferred for landscape work. Here is an appropriate quotation:

OCTOBER

THE MORNS ARE GAYER THAN THEY WERE,
THE NUTS ARE GETTING BROWN;
THE BERRY'S CHEEK IS PLUMPER,
THE ROSE IS OUT OF TOWN.
THE MAPLE WEARS A GAYER SCARF,
THE FIELD A SCARLET GOWN:
LEST I SHOULD BE OLDFASHIONED
I'LL PUT A TRINKET ON!

It was late in mild October,
And the long autumnal rain
Had left the summer harvest fields
All green with grass again;
The first sharp frosts had fallen,
Leaving all the woodlands gay,
Like the hues of summer's rainbow
Or the meadow flowers of May.
—*Whittier.*

Ask the children to close their eyes and try to see the picture in imagination; then let each child paint the picture as he sees it. The older pupils may grasp the picture from a single reading, but the younger ones should have an opportunity to study the stanza before attempting to illustrate it. See the illustration of October landscape, Color Plate One.

(c) AUTUMN LEAVES. A branch of oak or maple leaves makes a delightful study. Use them when the color is at its best. Try painting them in, without drawing, in what is called the free brush work. Do not have too many leaves on the branch—two or three will give a pleasing effect. See illustration with the poem on October, page 292.

(d) MOUNTING. Have a mounting lesson again to complete the month's work, and make an exhibit of the best work. See Section 21 (c), page 285.

Test. Make a drawing of a tree from nature. Use the pencil.

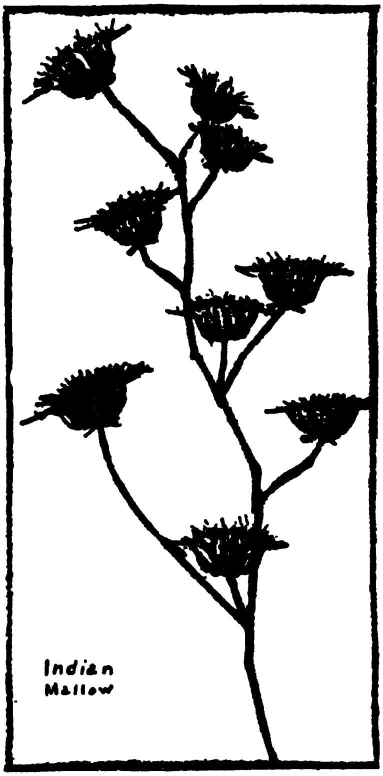
If you have water colors, paint a simple October landscape. If you have no colors, illustrate in pencil a simple poem.

Draw a fruit branch, in pencil.

NOVEMBER

Pleasant summer over,
And all the summer flowers;
The red fire blazes,
The gay smoke towers;
Sing a song of seasons,
Something bright in all;
Flowers in the summer,
Fires in the fall.

27. Nature in November. In this month Nature presents a changed aspect from gayly-robed October, but November has beauties all its own. Notice that the trees that were so recently painted with gorgeous dyes are showing now their characteristic lines in trunks, limbs and branches. The underlying structure of the trees may now be more fully studied and enjoyed than before. Can you tell the different trees when the leaves are gone? How many of your pupils can tell them? Choose a half dozen trees, and make a special study of them with the class. The sturdy oak, the graceful elm, the knotted apple tree, the symmetrical maple, the delicate birch, are as beautiful to the appreciative eyes of the nature lover, when the bare branches form delicate traceries against the sky, as when clothed with nature's most gorgeous raiment. Let the class express in pencil, crayon and water color the varied beauties of November.

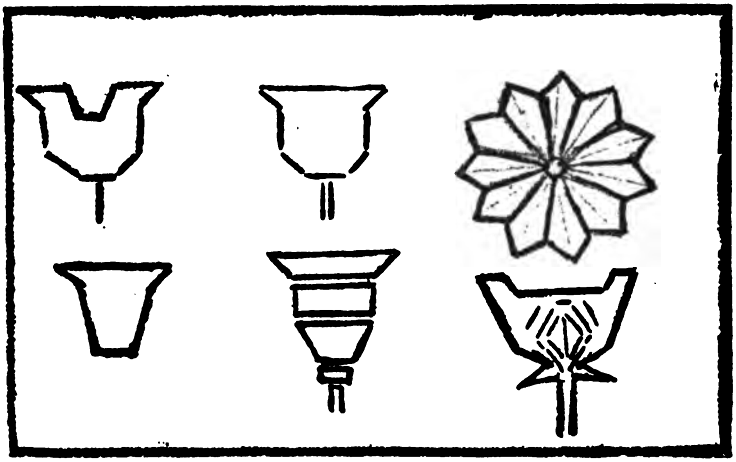


STUDY IN SEED VESSELS

So many of the interests of November circle around the home that we may well give them special thought for this month. The preparations for winter made by plants, insects, animals and man serve as suggestive motives to be incorporated into the art work.

From the morning talks develop interest in the following subjects: Pictures comparing nature in October and November (the trees, the skies, the ground); collecting

nature's stores for use in winter (fruits and vegetables, nuts and grains); Nature's treasure caskets (seeds and seed pods). Ask the children to collect and bring to school the various



DESIGN FROM INDIAN MALLOW

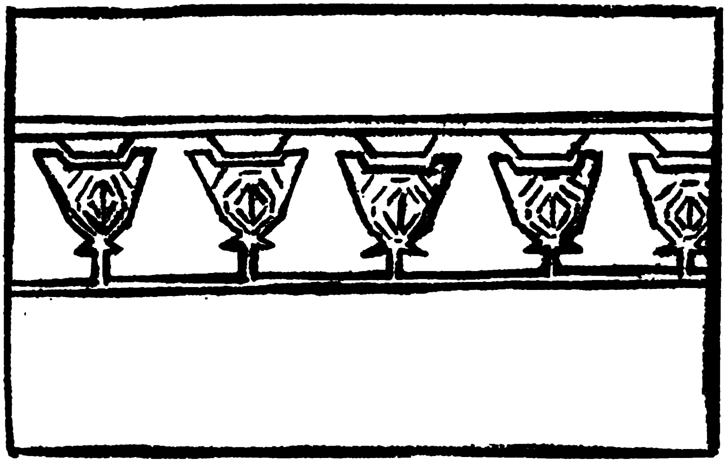
weeds having seed pods—the milkweed, the teasel, the Jamestown or jimson weed, the cat-tail, the thistle and the Indian mallow. Consult Section 8, page 270.

28. First Week. SEED PODS ON BRANCHES. Use manila paper 9 x 12, pencil or crayons.

Place the nature material where all the pupils can see it. The class should study the general direction of stems, the angles between the branches, the character and form of the pod, how the pod is attached to the stem, and other distinguishing features of the study. Draw marginal lines on the paper to give an idea of the proper space in which to draw the study. If the branch is long and slender, draw a panel shape, that is, a long oblong, folding the paper to indicate the required shape. The pupils should sketch in lightly at first, to show the stems and the shape of the pods. If the surface of the pod is rough or smooth, try to show that effect in the shading of the pod. If the pencil is used

in the first expression, try the colored crayons in a second lesson.

Save these drawings to use for design work in December. Save also some of the seed pods for use again. In the meantime they will make beautiful winter bouquets.

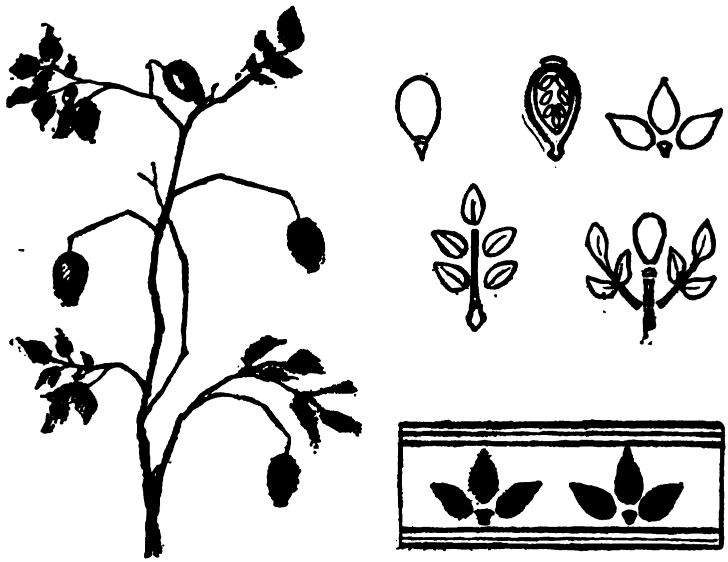


DESIGN FROM INDIAN MALLOW

29. Second Week. AUTUMN BERRIES. The rose hip or berry, the bittersweet, the green brier, the Judas berry and the poke berry are included under this title. Manila paper and colored crayons or water colors are good material for these studies.

If the colored crayons are used, see that the pupils match the colors as nearly as possible. They should also try to show the effect of light and shade in the berries, by adding some blue and brown on the shade side, even of the red berries, allowing the light paper to show through for the effect of light and high lights. If water color is used, it is a good plan to make a light wash of blue to show the shape of berries, and to drop in the bright color while the first light blue wash is still wet. Be sure that the brush is held upright in making the slender stems and leaves.

Save these drawings and the nature material for use later in design work. See illustrations for suggestive treatment.



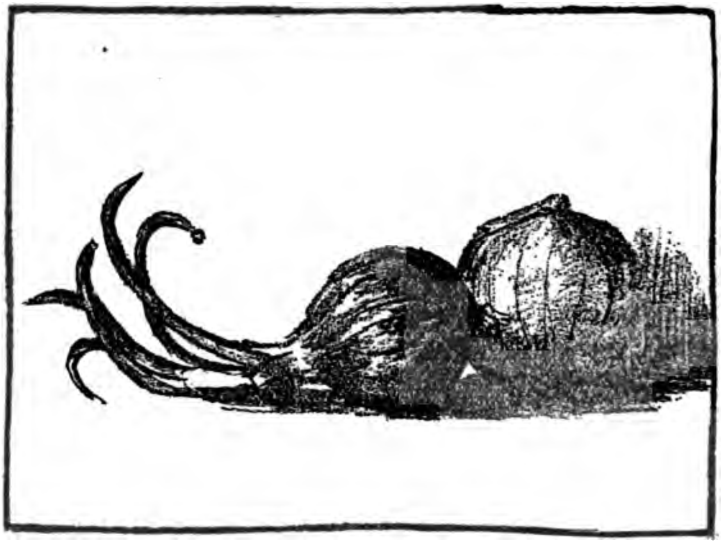
ROSE BERRY AND UNITS OF DESIGN

30. Third Week. FRUITS AND VEGETABLES. Use colored crayons or water colors. Ask the children to bring to school a pumpkin, a squash, potatoes, onions, apples, pears, or ears of corn in the husk. If the children have had only a little of this work, select for use the larger, simpler forms, in the order given in the list. Water color is the easier medium to use in representing the pumpkin or squash; but the colored crayons can be used. See Color Plate Two.

Place the object on your desk or on a chair placed on the desk, so it will be plainly visible to all. Study the general shape of the object. Is it round, or longer than wide, as illustrated in the pumpkin and the squash?

If working in water color, take the brush full of the proper color, and, starting in the center, make the mass the shape

to represent the object. *Do not outline* the object and then fill it in, for there is no outline to be seen, and the color should show the shape of the object. Add a little of all



STUDY IN VEGETABLES

these colors to represent the dark side of the object. If colored crayons are used, try taking a piece of crayon about an inch long and putting it flat on the paper; mass it in as you do in blackboard work. See illustration of the squash in color. Let the pupils try representing the large vegetables on the blackboard.

If the study of the corn is used, hang one or two ears from a nail, fastening them by some of the husks. This study is the most difficult of any of the vegetables enumerated, and should be used by upper grades only.

The study of the corn can be expressed in pencil, colored crayons or water color. If pencil is used, make a careful outline drawing first, then show details of the ear, and shade with slanting strokes. If colored crayon is the medium

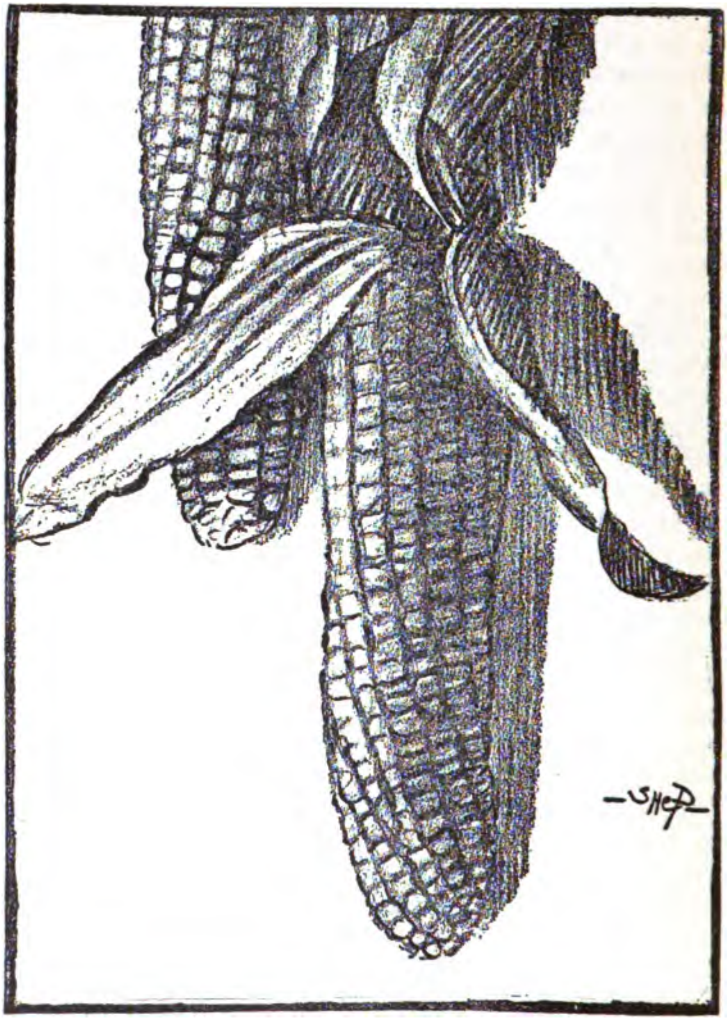
employed, mass in with the proper color, and then use darker brown to show the dark effects between the rows of kernels. Do not try to show all the marks between the kernels, but try to express the effect obtained by looking at the ears with eyes half closed. This shuts out all the small details, and gives the essentials which are necessary. When the drawings are completed, have the pupils hold them off at some distance and compare them with the study.

If potatoes or onions constitute the studies, the best medium to use is the pencil or black crayon. These are also good subjects for brush and ink work. See illustrations of vegetable studies.

31. Fourth Week. (a) OUTDOOR STUDIES. Collect pictures that suggest November and the Thanksgiving season. First secure those that suggest November landscapes. If someone has a camera, pictures of the surrounding neighborhood can be taken. But work from the window scenes can be done successfully. Ask the pupils to notice the different pictures they see in looking from the different windows. Sometimes a view from one pane of glass in a window will give a beautiful motif for a composition. A bare tree, carefully studied and drawn, makes an attractive study. Notice whether the tree sends a trunk through its entire length, or subdivides into many branches. The former is called the *excurrent* type, while the latter is the *deliquescent*. (See drawing of the elm, page 287.) Ask the pupils to name the trees they can think of that are like each of these types. The Lombardy poplar, the trees of the evergreen family, the beech, the sycamore, and some oaks are excurrent in type, while the greater variety of forest and cultivated trees, including fruit trees, maples, most oaks, the elm, the cottonwood and some others, are deliquescent in type. Next observe the arrangement of the branches. Are they opposite or alternate? Notice the angle which the branches form with the trunk. Show the irregularity of the little branches and twigs.

(b) CALENDAR. Plan a November calendar as suggested by Color Plate Three. Perhaps you can suggest some

squirrels in the trees. Plan the spaces for the illustration, the poem and the calendar, to produce a pleasing arrange-



STUDY IN INDIAN CORN

ment. The pencil or water colors may be used appropriately in making the November calendar. If possible, give space

on the blackboard for a calendar with suggestive illustration for each month.

(c) THANKSGIVING TEXT. While the fifth and sixth grades are making an illustrated calendar, the upper grammar grades can plan, and make a beautful illumined text. For plan, see Color Plate Six.

Choose some text in harmony with the thought of the season, and on paper lined in small squares plan the words of the text in plain letters. Use simple block letters, or, if you prefer, a more ornamental type, such as the Old English or Gothic style, may be used. The titles of books and magazines will furnish good examples of printing. Ask the children to look in newspapers for plain block letters.

The design will be more attractive if some of the fall nature studies are used to decorate the text. The berries, seed pods, or the Thanksgiving flower—the chrysanthemum—could be used. To make the nature study suitable for such a decoration, draw it carefully and apply the color in a flat wash on flower and leaves; then, when that is quite dry, outline each part with a strong black line, using black water color.

(d) CORRELATIONS. If the children are studying colonial history, it would be interesting for them to make a sketch of the "Mayflower" in a decorative treatment, to use as a cover for their written exercises in this branch.

(e) MOUNTING. Give the pupils an opportunity to mount their drawings and paintings on large size manila paper, 9 x 12, and make an exhibit of the work done in November.

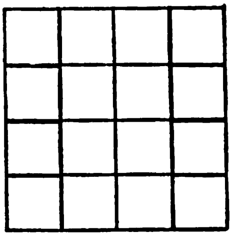
Test. Make a study of a seed pod on the stem, in pencil; also a study of a vegetable, in pencil or crayon.

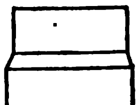
Draw something appropriate for Thanksgiving.

DECEMBER

The world is happy,
The world is wide;
May joy be yours
This Christmas-tide.

32. Construction Work. Let the work of this month be influenced by the interest of the children in preparing gifts for the Christmas festival. This work will afford some good problems in constructive and decorative design. Instruction should be given to aid the pupils in constructing objects from working drawings. When a working drawing is introduced in this way, its function is readily understood. It means little to the child to make a working drawing of an object, if, in the end, that drawing is not put to some definite use. Through conversation with the children, learn some of the things they would enjoy making, to use as holiday gifts. You might volunteer such suggestions as a candy box, handkerchief box, glove box, work basket, scrap basket, decorated calendar, illuminated Christmas texts.





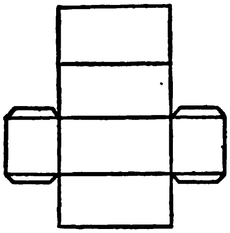
Box made from
Folded Square
Cut on dark lines

33. First Week. (a) WORKING DRAWINGS. Explain to the children that when any object is to be constructed, either large or small, from a house to a small box, that drawings are first made which give all the facts and details of the form of the object. These are called *working drawings.* The size, proportions, decoration and materials used are fully explained in connection with a working drawing.

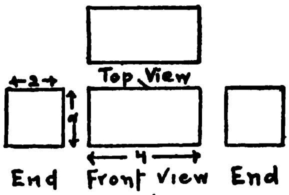
Working drawings may represent different views of the object, as the front and side elevations of a house, showing the placing of doors and windows, and shape of the gable; or they may show the development of the whole surface, as a pattern of a dress, or of a box to be made of cardboard. This method is usually employed when objects are to be made of flexible material, such as paper, cloth and tin. Patterns are used as working drawings. When objects are to be constructed of wood, stone and other inflexible material, different views of the object, with measurements, are then given.

To illustrate the making of a pattern, or to show the development of the surface of an object, which is the same as a pattern, a very simple problem may be given to the children in the development of the surface of a box.

The box has a top, bottom and four side faces, so the pattern must have six faces, or sections. Folding a paper



Pattern for Box -



Working Drawing of Box

over a box, and creasing the sides along the edges, will show the proper placing of these faces, in relation to each other.

A simple pattern may be developed by folding a square of paper into sixteen small squares. Fold it first on its diameters, then fold the upper and lower edges *to* the diameters, thus making sixteen small squares. Now cut on the folds between the squares, and lap the squares not needed in the actual surface of the box. See the illustration, page 302. From a pattern thus developed, made of cardboard, a candy box can be constructed and covered with bogus paper or any other paper you wish to use.

(b) Making Boxes. The materials necessary for box making will consist of cardboard, rulers, scissors, paste and cover paper, which may be the ordinary manila drawing paper, colored paper, bogus paper, or plain colored wall paper. Ask the children to bring old pasteboard boxes to school to be used in making gift boxes.

If a glove or handkerchief box is desired, let the pupils consider the size and proportion of these boxes best suited to the shape of the objects they are to contain. A square box is most suitable for handkerchiefs, and a long, narrow

box for gloves. A handkerchief box should be 5 inches wide, 5 inches long and 2½ inches deep. A glove box should be about 8 inches long, 3 inches wide and 2½ inches deep, according to the size of the handkerchiefs or gloves.

For the handkerchief box, measure on the cardboard, with the ruler, and draw the various faces of the box, making the top and bottom faces 6 inches square, to allow a half inch projection on all sides, and four pieces 5 x 2½ inches, for the sides of the box.

For the glove box, cut two pieces 9 x 4 inches for top and bottom; two pieces 3 x 2½ inches for the ends, and two pieces 8 x 2½ inches for the sides.

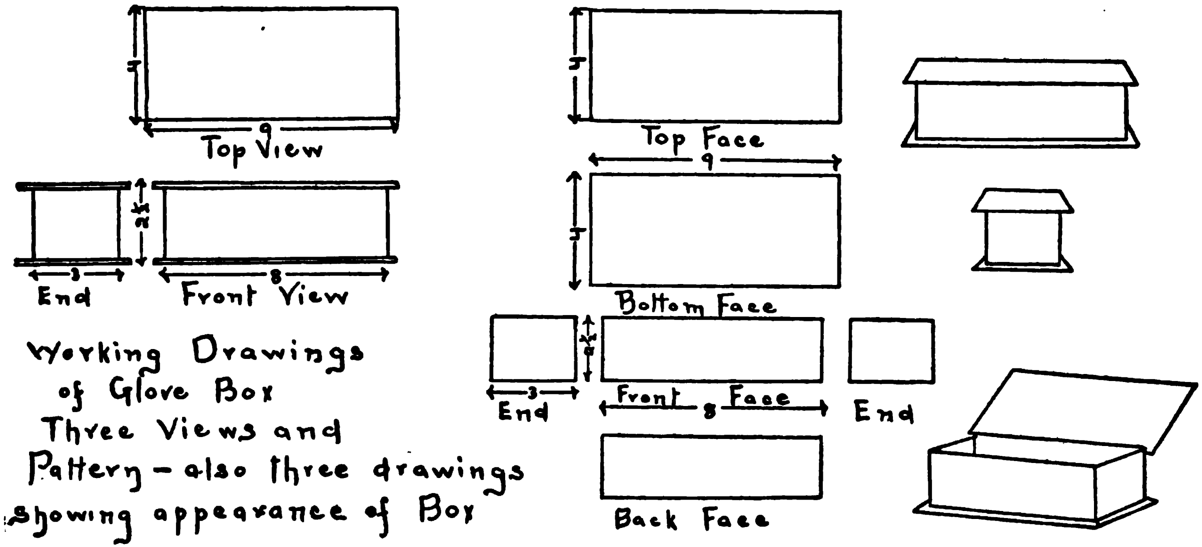
The next step is to cover the separate pieces with the cover paper. Lay each piece of cardboard on the cover paper, and mark around it. Allow a half inch for laps around all sides of these cover pieces. Fold the laps over the edges of the cardboard, and paste the four laps over on the top and bottom faces of the box; but on the remaining sides paste down one long and one short side only. The remaining laps will be pasted to each other to hold the box together.

The top and bottom pieces of the box should be covered on both sides with cover paper, and the inside of the box should be lined with a long strip of paper to fit each side. The lining paper at the back should be allowed to extend above the edge of the box one-half inch, and this should be pasted at the back edge of the top of the box to serve as a paper hinge.

The beauty of the work in construction will depend upon its accuracy and neatness.

(c) Work Basket. If a work basket is to be constructed, a pattern may be developed by drawing a hexagon for the base, and having the six sides fastened to it and to each other.

Draw a circle with a radius of 2 inches. If compasses are not at hand, make a simple compass by taking a strip of cardboard and placing a pin at one point, and push a pencil



Working drawings are drawn to a scale; that is, they are made proportionately larger or smaller than the object. The drawings for small objects, like the works of a watch, are made larger, and those for large objects, like parts of a wagon, are made smaller than the object. The measurements of working drawings must be exact.

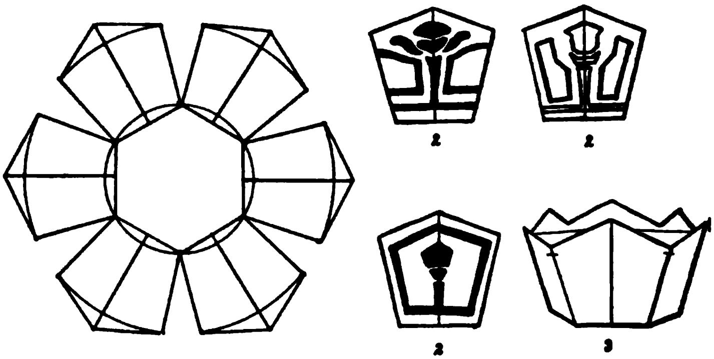
Working drawings deal with the facts pertaining to the construction of an object, and not with the appearance of the object.

Five kinds of lines are used in working drawings:

(1) Center lines, indicated by a dot and a dash -·-·-·- They are also called construction lines.
(2) Full lines, representing visible edges ————.
(3) Dashed lines, representing invisible edges - - - - -.
(4) Dotted lines, connecting views . . . . . .
(5) Light lines, indicating measurement.

point through a small hole made in the cardboard, at the distance of the radius of the required circle from the pin. The circle may be described accurately with this simple device, by swinging the pencil around the pin as a center. Divide the circumference into six equal parts, by using the radius as a unit of measurement, making a hexagon. On a two-inch base construct the sides of the basket, making them 3 inches in height and 3 inches in width at the widest place.

After the hexagon base and six sides have been cut from cardboard, cover them with colored paper or cloth, using



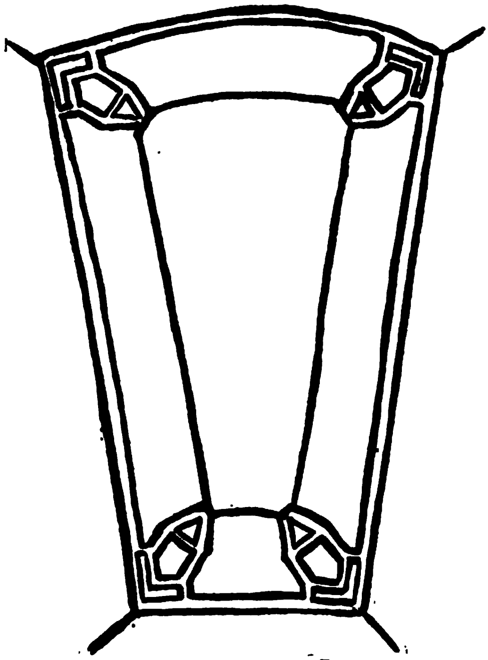
1. PATTERN FOR WORK BASKET
2. DESIGNS FOR BASKET
3. APPEARANCE OF BASKET

plain gingham or linen, and sewing over and over nicely for this purpose. The same is used as in covering the sides of the box previously described. If cloth is used, the cover may be sewed over and over with fine stitches and thread to match. The sides may then be stitched together, and then stitched to the base. If paper is used, instead of fastening the sides by pasting the laps in place, as you did in making the box, they may be held in place by a cord passing through holes punched in each side of the six faces, and tied together in this manner. See illustration of basket.

(d) WASTE PAPER BASKET. Construct a waste paper basket having a base 4 inches square, and four sides each

12 inches long, 4 inches wide at the base and 8 inches wide at the top.

Draw the pattern and make the basket of cardboard, and cover it with paper as described in previous problems in construction work. Plain or figured wall paper may be used for covering the baskets. Some children may wish to bring remnants of wall paper from home so the basket will match the paper in their home, and their wishes should be respected. In general, however, the plain paper is to be preferred.



DESIGN FOR WASTE BASKET

34. Second Week. (a) DECORATING BOXES AND BASKETS. The most appropriate decoration for the boxes and baskets will be obtained by studying the nature material we used in the art lessons during the fall. The leaves, flowers, nuts or seed pods, berries, and holly, with its bright red berries and dark green leaves, are all appropriate.

While the units to be used in the designs may be suggested by nature subjects, they should not be copied in their natural forms. Each unit should be adapted to suit the needs of the design. Illustrations may be given and worked out by the children, as the plates of design units from the rose hip and Indian mallow suggest. See illustrations.

Ask the children to select for a border design some unit from the subjects studied during the fall, such as a leaf, a flower, or a seed pod; then assist them to modify and apply this unit in accordance with the plans shown in the illustrations. After a unit has been selected, consider the space to be decorated, and make such an adaptation of the unit

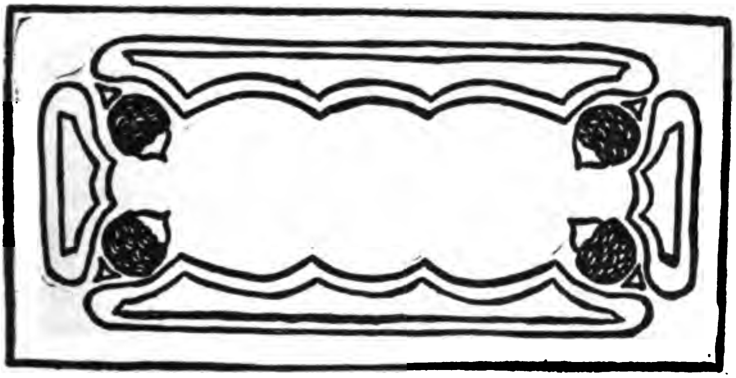
DESIGN FOR BOX COVER

as will produce the most pleasing effect. If the space is small, as the side of a work basket, a single unit or a row of units may be chosen, making a border, as suggested in designs for the top of the box. Another good design can be made by filling the corners, connecting them with lines, as the design for the scrap basket suggests. Again, the surface may be covered, as the design of milkweed pod suggests.

(b) CONVENTIONALIZED FORMS. A design worked out from a nature motif, as suggested above, is said to be a *conventionalized* form, that is, a nature unit made conventional, or formed for use in design. This method of adaptation of nature's forms is in accordance with the principles of good design, but to copy a nature form without adapting it to the form of the object to be decorated is a violation of these principles.

In a conventional design all irregularities of growth are omitted, the aim being to produce a perfect form that will be graceful and symmetrical and yet show clearly the form from which it was taken. It should always be adapted to

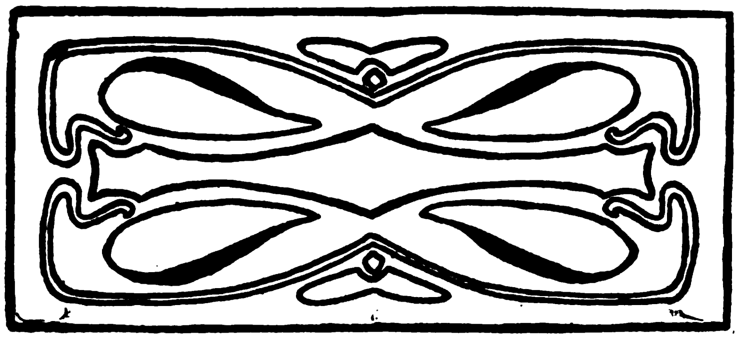
the use to which it is to be put. If it is to be used in a border, or in a surface covering, it must be so arranged that



DESIGN FOR BOX COVER

a repetition of it will produce a harmonious effect. Study the illustrations given on pages 296 and 297.

Many objects to be found in the stores are decorated (so called) by the mere copying of flowers, figures or land-



DESIGN FOR BOX COVER

scapes in a naturalistic treatment, but these decorations can in no sense be called designs, or even good decorations.

From time to time give the children talks on what should constitute a good design, and call attention to the many violations of the canons of good taste in the objects found

in the stores. China ware is not decorated in the best sense of the term by the painting of flowers, heads, figures or landscapes, rendered in a naturalistic way. Such decoration belongs to the field of picture making, and is not true decoration of objects.

(c) Application of Designs to Objects. After a design has been made for the box or basket constructed by the child, it can be transferred to any object by the use of transfer paper, by a tissue paper copy made and drawn over the lines, or by a stencil.

A *stencil* is a pattern so cut as to leave the design in open spaces, through which a drawing or painting may be made.

LAMP SHADE

Care should be used to have each part of the design separated by a little space, if a stencil is to be cut, or the pattern will fall to pieces.

It is well at this point to show the pupils how to transfer their designs by each of the methods given. Let them apply the design to the object, and paint the same with flat tones, in harmony with the color of the cover paper. It is not necessary to imitate the color that nature suggests, but if such coloring is chosen, let each color be grayed by using a little of all three colors, to make a harmonious combination. Tones of the color that the cover paper suggests make a very pleasing effect.

35. Third Week. This week is usually the closing one before the holiday season, and may be profitably spent in any of several ways.

(a) DECEMBER CALENDAR. A calendar for this month may be decorated by using a winter landscape or some nature subject which suggests the season. A branch of holly, or of fir with cones, or the beautiful poinsettia may be chosen. Ask the children to bring a calendar pad and a piece of cardboard. Cover the cardboard with colored paper, and mount the picture you have made, together with the calendar pad, upon it. Paste a loop at the top, or paste a piece of cardboard to the back to make it into an easel, so the calendar will rest on the table. See the illustration for November calendar, Color Plate Three.

(b) WINTER POEMS. Read to the children some beautiful poem about winter, and ask them to illustrate it. One suggestion is from *Snow-Bound* (Whittier), the selection beginning:

> So all night long the storm roared on;
> The morning broke without a sun.

Others in which good material may be found are *The First Snow Fall*, Lowell; *Winter*, Trowbridge; *December*, Emerson.

(c) ILLUMINATED TEXTS. If it is desired, appropriate Christmas texts may be made by children in upper grammar grades, as suggested under work for November; or printed texts may be used and illuminations made in color.

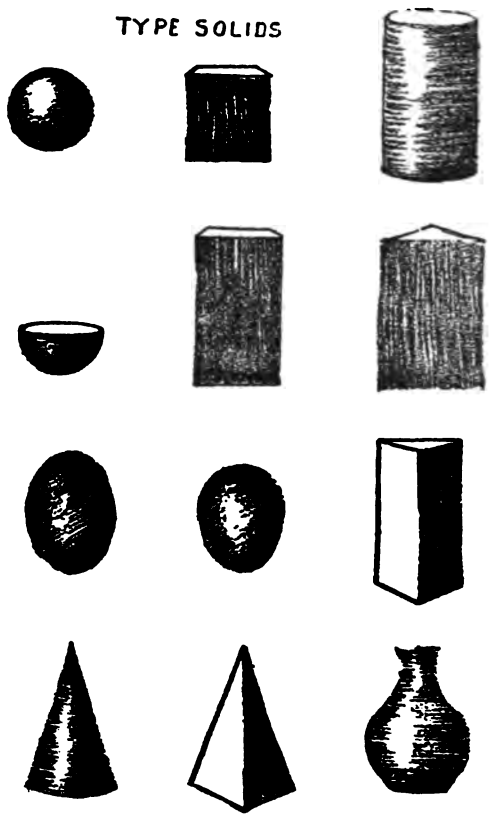
Some very beautiful texts are made expressly for this purpose, and are quite inexpensive. These cards are printed in decorative type, and the decoration is carried in outline, which may be filled in with color by the children. The text may be further embellished by use of gold paint in outlining the decoration. These cards give the children some excellent examples of beautiful painting, and show how nature forms may be adapted to the use of design. Such cards may be procured of Miss Nellie Trufant, 2614 Clinton Ave., Minneapolis, Minn., or of Atkinson, Mentzer & Grover, 223 Washington St., Chicago.

Test. Make a working drawing of a square handkerchief box, 5 x 5 x 2½. Make a design for the top of a box, using a 5 x 5 square. Use a conventionalized nature form—seed pod, holly berries or other appropriate decoration.

JANUARY

A Happy New Year, a Happy New Year,
Oh send it afar,
To the girls and the boys wherever you are;
To the rich and the poor, the high and the low,
Oh! scatter its blessings wherever you go.

36. First Week. (a) VACATION STUDIES. We have all enjoyed the holiday season, and now return to our work with renewed energy and a desire to get the most out of the new year. The children will be interested in telling you of their Christmas joys. Let them illustrate with crayons, pencil or brush, something they did during vacation. Illustrate sliding down hill, skating, snow-balling, helping mother or father. Try making a January landscape with the poem on the blackboard.



(b) SOLIDS. We are surrounded by

a world of objects that become more interesting as we become more familiar with them. We have given special attention during the fall months to the objects in the world of nature. We will give special regard during the next two months to the objects in the world of arts and manufactures. All objects are modified forms of a few types. Froebel classified all forms under three types, namely, the sphere, the cube and the cylinder. Ask the pupils to name a number of familiar objects resembling the sphere, as, fruits, vegetables, etc.; objects like the cube, as blocks, boxes, baskets, stools, tables, buildings, etc.; objects like the cylinder, as tree trunks, stems and some flower forms, besides many manufactured objects, such as bottles, jugs, pails and barrels. After a little study, the children will discover that many objects only remotely resemble any of these types, and so for convenience other types have been added, which are modified forms of the first three. The complete list is as follows: sphere, cube, cylinder, hemisphere, square prism, right-angled triangular prism, ellipsoid, ovoid, equilateral triangular prism, cone, square pyramid and vase form. There are twelve in all, and for convenience they may be divided into groups of three. Name objects like each.

(c) DEFINITIONS. Describe each form as to kind and number of faces, edges, etc., as follows:

The *sphere* has one round face.

The *cube* has six equal plane square faces, twelve straight edges and eight corners.

The *cylinder* has two plane faces and one curved face and two curved edges.

The *hemisphere* has one plane face and one rounding face, and one curved edge.

The *square prism* has six plane faces, two square faces and four oblong faces.

The *right-angled triangular prism* has five plane faces, and the two ends, or bases, are right-angled triangles.

The *ellipsoid* has one rounding face having two rounded, small ends.

The *ovoid* differs from the ellipsoid by having one end larger than the other, being egg-shaped.

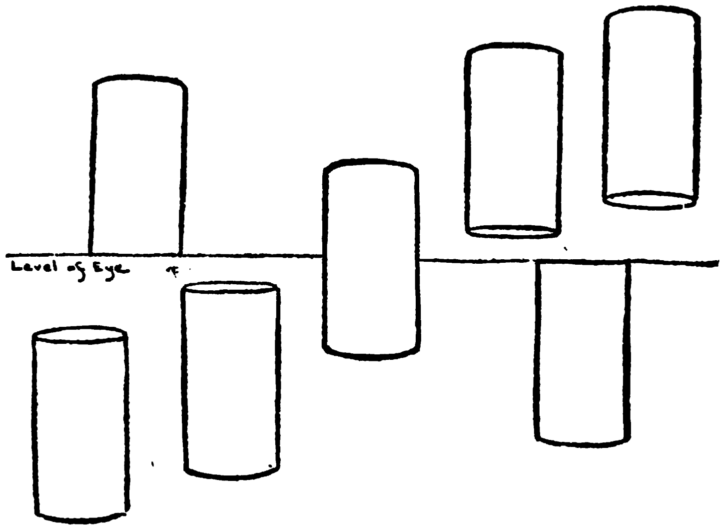
The *equilateral triangular prism* differs from other prisms by having equilateral triangular ends, or bases.

The *cone* has one plane face and one curved face, and one curved edge.

The *square pyramid* has a plane square base, having four equal plane, triangular faces that meet at a common point called the vertex.

The *vase form* has two plane faces and one rounding face having reversed curves.

(d) PERSPECTIVE. The study of the appearance of form and representing forms as they appear, without regard to



CYLINDER IN DIFFERENT POSITIONS

facts of form, is called *perspective.* All objects may be grouped under two heads in the study of perspective, namely, cylindrical perspective and rectangular perspective.

Cylindrical perspective deals with objects that resemble the cylinder, having curved edges.

Rectangular perspective includes the study of objects having rectangular faces and straight edges.

After the children have had a number of lessons on the study of types of form, ask them to make a cylinder by

rolling a piece of 6 x 9 manila paper, and pinning it in place. Ask the children to hold the cylinder upright, at arm's distance, and observe the changes in the apparent form of the top and bottom faces. Hold it out so that the top edge is on the level of the eye. Lead them to observe the essential points by such questions as these: How does the circle appear in that position? (Answer: A straight edge.) How does the bottom edge appear? Put your pencil under the lower edge, and notice the downward curve of this edge. Could you draw the picture of the cylinder in this position? Draw what you see, on the paper and on the blackboard. Again, try placing the cylinder with the bottom edge on the level of the eye, and draw what you see. Place the cylinder below the level of the eye, about on a line with your shoulder; can you see into it? How does the circle appear now? (Answer: A narrow ellipse.) Place the cylinder still lower; how has the top changed in appearance? (Answer: It appears a wider ellipse.) Now place the clyinder above the level of the eye, and watch the gradual widening of the ellipse at the bottom. Carry these observations far enough to establish these principles regarding the appearance of the circle:

(1) The appearance of the horizontal circle on the level of the eye is a straight edge.

(2) When the circle is seen obliquely above or below the level of the eye, it appears an ellipse.

(3) The nearer the horizontal circle is to the level of the eye, the narrower the ellipse appears.

(4) When the horizontal circle is seen directly above or below the eye, it appears as a full or complete circle.

Draw the cylinder with relation to the eye-level in the following positions, and note the change of appearance of the circular bases.

(1) Draw the cylinder with the top on the level of the eye.
(2) Draw the cylinder with the bottom on the level of the eye.
(3) Draw the cylinder with the middle on the level of the eye.
(4) Draw the cylinder a little above the level of the eye.
(5) Draw the cylinder a little below the level of the eye.

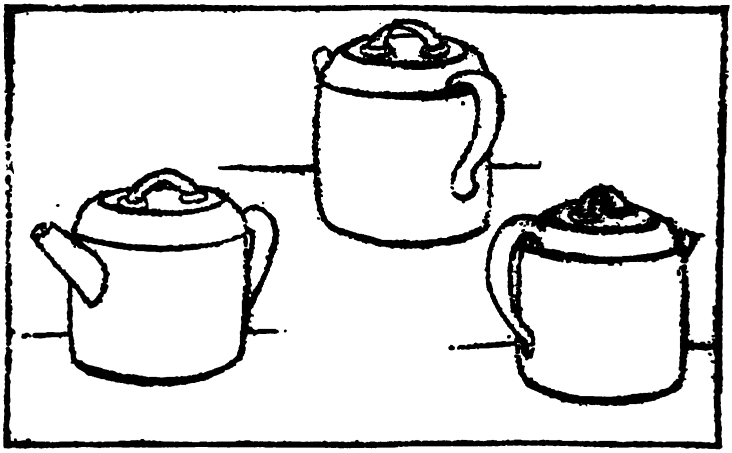
Draw a horizontal line across the center of the paper, to represent the level of the eye, and draw the cylinders in rela-

tion to that line. See the illustration of the cylinder in different positions.

Caution. It will be well to give the foregoing study of type solids slowly, according to the ability of the children to receive it. The first group may be given the first week, the second group of three the second week, and so on, letting the work cover the whole month, if necessary.

37. Second Week. APPLICATION OF PRINCIPLES. After the pupils have a working knowledge of the principles learned in studying the cylinder, ask them to bring to school objects resembling the cylinder—a tin cup, a pail, a crock, a jar, a flower pot, a jug. Use also the objects found in the schoolroom—the cup, pail and dinner pail.

Study the proportions of each object. Proportion is the relation of height to width. Teach the children how to find

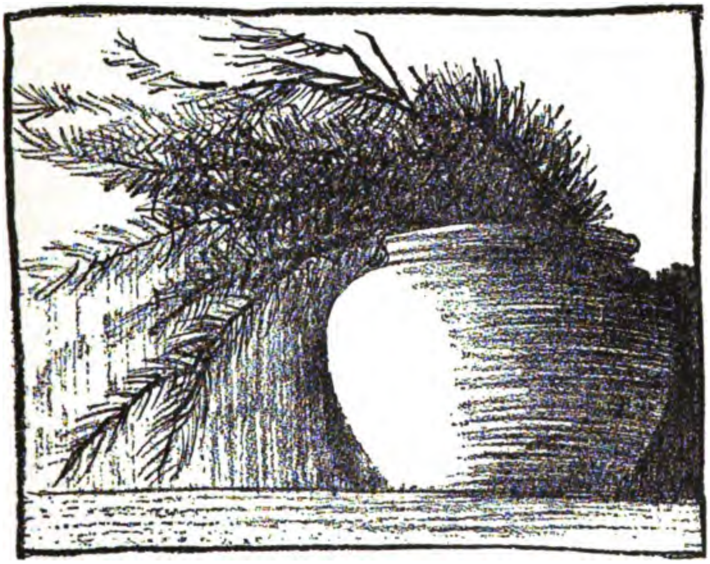


CYLINDRICAL OBJECTS IN OUTLINE

proportions by measuring on their pencils, held at arm's length, with one eye closed. Hold the pencil vertically at arm's length, allowing the top of the pencil apparently to touch the top of the object, and let the thumb indicate on the pencil where the bottom edge comes; this shows the apparent height of the object. Now, with the pencil held

horizontally, compare the apparent width with the apparent height.

Use manila paper for sketching, and draw several of these simple objects in outline. Draw two light lines to suggest the height of the object, then two lines to suggest the proportionate width. Make the sketch as large as will suit the



STUDY IN LIGHT AND SHADE

size of the paper. Look carefully at the proportions of the ellipse at the top, if the object is placed below the line of the eye; and if placed above the eye level, as on the teacher's desk or upon a box or chair placed on the teacher's desk, notice the upward curve of the upper edge. What kind of a line will you draw to represent the base, if the object is above the level of the eye? (Answer: If it is on a box above the eye level, draw a straight line to represent the edge of the box. If the object is below the eye level, indicate the downward curve at the base.) Draw from various objects

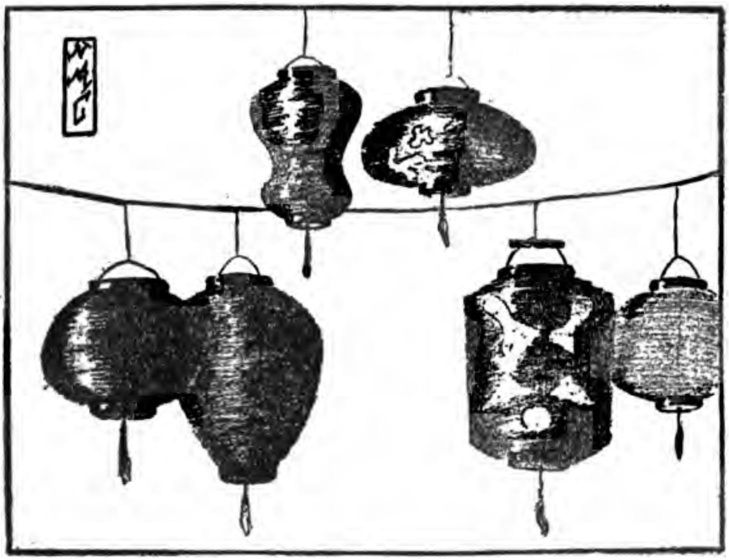
in outline, using pencil and manila paper. See illustration of objects drawn in outline.

38. Third Week. OBJECT DRAWING. Objects showing dark and light color in the ware, crocks and jugs, brown and white bowls, furnish excellent studies. Use manila paper and pencil or crayon. Place the objects on boards between the desk, so that children along two rows can see the object well. One object placed in every other aisle will be sufficient, unless the object is small; then place two objects in the aisle, putting one half way down the length of the aisle on a board placed across the desks. By leaving an aisle entirely free, it gives opportunity for the teacher to pass through for class criticism.

STUDY IN COMMON OBJECTS

Sketch the outline lightly with pencil or brown crayon, first indicating by light, sketchy lines, called *blocking in*, the general proportion of the object. After the outline is sketched in lightly, study the object to see what parts are of dark color and which are light, then with pencil or crayon show by lines drawn parallel to the curve at the top, the dark

part of the object. Is there a high light on the light side of the object? If so, look carefully at its shape and leave that spot the color of the paper.



LANTERNS IN LIGHT AND SHADE

Try several different objects, showing the effect of dark and light, as suggested by the illustrations.

39. Fourth Week. (a) OBJECT DRAWING (CONTINUED). The purpose of the study of objects this week will be to see and express the effects of light and shade. Use the same materials which were used last week. The objects must be placed to receive light from one side of the room; the window shades should be lowered at the back and other side of the room, if there should be windows on more than one side. Choose some light colored object; a flower pot, bowl, peck measure or bushel basket will be suitable. If the object is small, place it on the boards between the aisles; if large, it may be placed on the teacher's desk. Ask the children to observe the effect on the light side, and compare with the shaded side of the object. If you can see into the

object, compare the color effect of the ellipse with the outside of the object.

Sketch in as before, and, leaving the light side the color of the paper, show the dark side by pencil or crayon shading, or painting with the pencil, as it is called. See the illustraions for January work.

(b) REVIEW. Review the work of the month by calling for blackboard work, making memory sketches from objects previously drawn.

Test. Name two objects like each of the following type solids: sphere, cube, cylinder, square prism, cone, triangular prism.

Draw a cylinder in five different positions with reference to the level of the eye.

Draw from a cylindrical object having a handle (a cup or a pail), placed below the level of the eye. Draw in outline.

Draw from a group, a tumbler and lemon. Use the pencil.

Write the principles pertaining to cylindrical perspective.

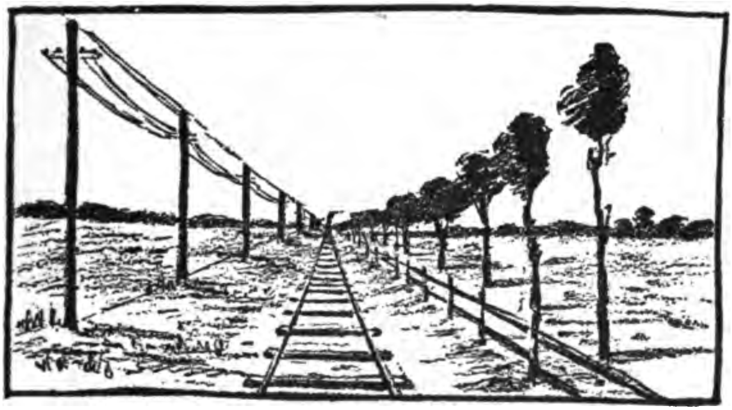
FEBRUARY

Sunset red and quiet air;
Ponds are ice and trees are bare;
Fields are frozen far and near;
February days are here;
Bitter cold the night draws down
On the country and the town,
But in cheerful warmth we sit,
And the nursery lamp is lit.

—*K. Pyle.*

40. First Week. (a) FEBRUARY POEM. Read the children this poem, descriptive of February, and ask them to imagine the picture. Then let them represent this picture with water colors or colored crayons, bringing out the sunset sky, the bare trees and ponds of ice. Some may like to picture the skaters on the pond. Perhaps the ground is white with snow; if so, leave the paper the natural color, to represent the white ground. See Color Plate Four.

If the landscape is to be done in water colors, moisten the paper with one or two brushfuls of water, and tint the sky space to suggest a bright sunset, using red or red and yellow, blending the colors together, as you recall seeing them in an evening sky. Practice making bare trees, such as you can see from the window, on a dry paper, while the sky is drying a little. Then try the same on the first paper. Hold the brush upright, to get a fine, firm stroke for the little branches. The icy pond may be shown with a gray, blue-green color, made by mixing all three colors (blue, yellow



ILLUSTRATING APPARENT CONVERGING OF HORIZONTAL RECEDING LINES

and a little red). If the pupils have no water colors, a study in brush and ink work or colored crayons may be used. If these little landscapes are saved, each can be mounted with an appropriate verse for a valentine.

(b) Landscape Illustrating Perspective. Use the landscape to illustrate to the children the appearance of receding lines and edges as they are noticed in the road, railroad, telegraph poles, trees and houses in perspective.

By questioning, the children may be led to recall that the parallel horizontal receding lines found in railroad tracks, seem to converge or come together, and if you can see them at a great distance, they appear to meet at the horizon,

or eye level. Illustrate this principle by drawing a horizon line, and lines for track converging to a point. Add lines parallel to these lines, converging at the same point, to indicate lines for telegraph poles and trees at either side. Draw lines for tops of telegraph poles and trees, converging to the same vanishing point. Finish the sketch by drawing vertical lines for poles and trees, making the distance between them less and less as they approach the horizon. Finish by drawing in the details—telegraph wires on the poles, foliage on the trees, ties on the track, and other details of the landscape. Illustrate these points by drawing on the blackboard while the children follow with pencils and paper.

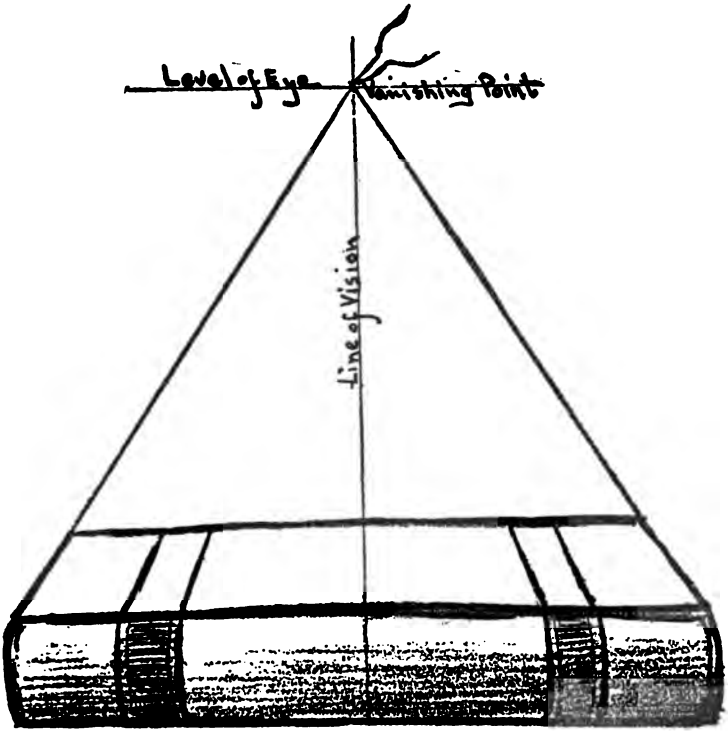
41. Second Week. RECTANGULAR OBJECTS. After the children have observed the appearance of parallel horizontal receding lines in the landscape features, it will be well to follow this exercise with observation of rectangular objects in the schoolroom.

(1) *Book.* To further demonstrate the principle that parallel horizontal receding lines appear to converge, and if sufficiently extended will meet at a point on the level of the eye, called the *vanishing* point, allow the children to make the following experiment:

Take a book and a long string; slip the string under the cover of the book close to the back edge. Now place the book as far away from the pupil as possible, resting it on the desk, with the back of the book toward the observer. Take the string at both ends, and by holding the ends of the string slanting toward each other, and closing one eye, adjust the string apparently to conceal the short, receding edges of the book. If the string is sufficiently long, the ends will cross at the eye level, proving the statement made at the beginning of this lesson. What was observed in the railroad is also true of even short horizontal parallel receding lines.

To find the apparent width of the face as it rests on the back of the desk, place a ruler upright on the back edge of the book, and let the finger or a pencil indicate how many

inches wide the top face *appears*. Close one eye to make all these observations. With the strings in position again, the apparent length of the *farther* edge may be discovered by

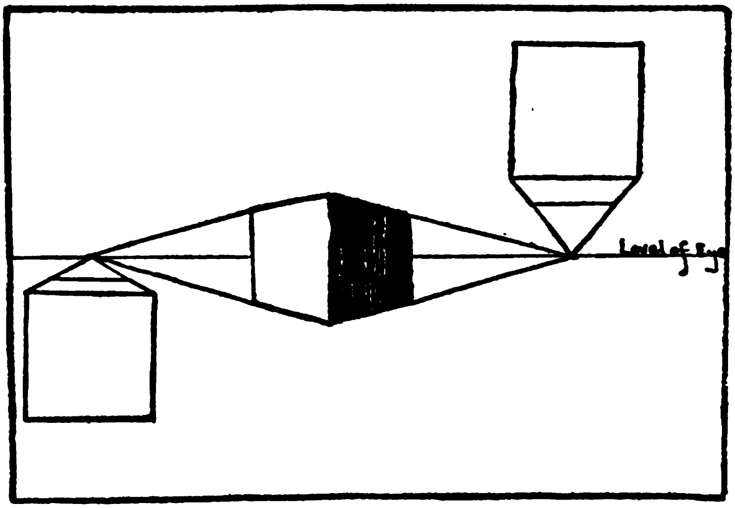


EXPERIMENT ILLUSTRATING CONVERGING OF HORIZONTAL RECEDING LINES

measuring between the two farther corners, on the ruler, placing it against the strings.

Make a large drawing of the book, dealing with the actual measurements of the back, and apparent measurements of the top. Use a comparatively thick book, as a school reader, for this exercise. If the drawing is made smaller than the actual size of the book, the measurements must all be reduced proportionately.

(2) *Cube.* After experimenting with the books and strings, next let the children observe the hollow cube. Fold a strip of manila paper, 2 x 9 inches, to make a two-inch cube. Observe the cube as it looks, with a face toward you and on the line of the eye. How many faces do you see?



CUBES IN PERSPECTIVE

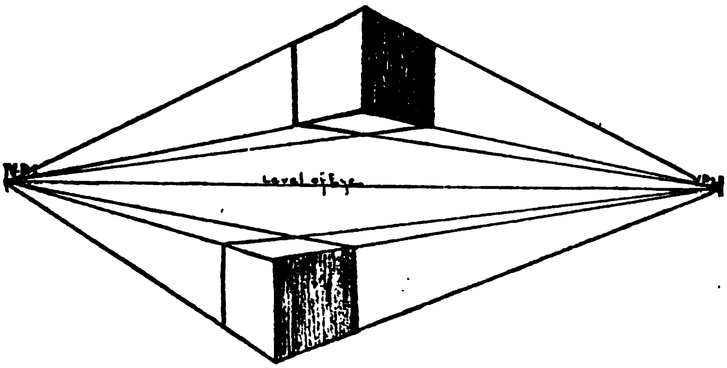
(Answer: One face.) Draw what you see. Keeping the face towards you, hold the cube a little below the line of the eye. What face comes into view? (Answer: The top face.) How does it look? (Answer: Foreshortened.) How wide does it look? Lower it and notice the change. Notice the converging lines of the receding edges. Draw the cube in this position.

Hold the cube a little above the line of the eye. What face comes into view? (Answer: The bottom face.) How does it look? (Answer: Foreshortened.) Draw it as it appears. Draw on 9 x 12 paper a long horizontal line to represent the eye level. Draw the appearance of the cube as it looks when the top edge is on the level of the eye; when a little below the level of the eye, and when a little above

the eye level. Note the extended lines which come to a point on the level of the eye. See the illustration.

After the foregoing is quite clear to the children, try placing the cube turned with one edge toward you and the sides turned equally away. Hold it by the back corner, and observe how it looks when a little below the level of the eye, and also a little above the eye level. The top face and the bottom face in these positions resemble what figure? (Answer: A diamond shape.) Notice the slant of the side lines. There will be a group of parallel lines that will converge to a vanishing point at the left, another set at the right, the vanishing point being on the line of the eye. Illustrate this by drawing these two sets of converging lines on the blackboard, showing the two vanishing points.

Teach the children how to measure the foreshortened faces by measuring with the ruler from the front edge out



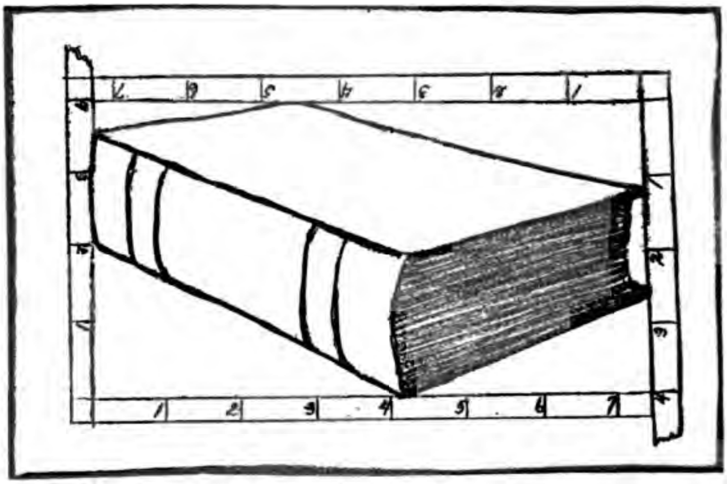
CUBE ABOVE LEVEL OF THE EYE, DRAWN AT AN ANGLE OF 45 DEGREES
CUBE BELOW LEVEL OF THE EYE, DRAWN AT AN ANGLE OF 45 DEGREES

straight to the left and right, not on the slant. The two faces will appear equally foreshortened. We saw the cube turned at an angle of 45°.

At the next lesson develop the problem when the cube is turned so that one side appears smaller than the other. Place the cube on the back of the desk. Draw the vertical edge which is nearest and shows the actual height. Measure

with the ruler, touching the front edge, to find how far to the right and left the farther edges must be drawn. Place the ruler flat on the desk, just touching the front vertical edge, and notice the angle made between it and the lower receding edges. The more foreshortened face will be drawn at a greater angle from the horizontal line which indicates the position of the ruler than the less foreshortened face.

After these base lines have been drawn correctly and the width of the faces indicated, the other lines must be drawn



BOOK DRAWN WITH THE AID OF FINDERS

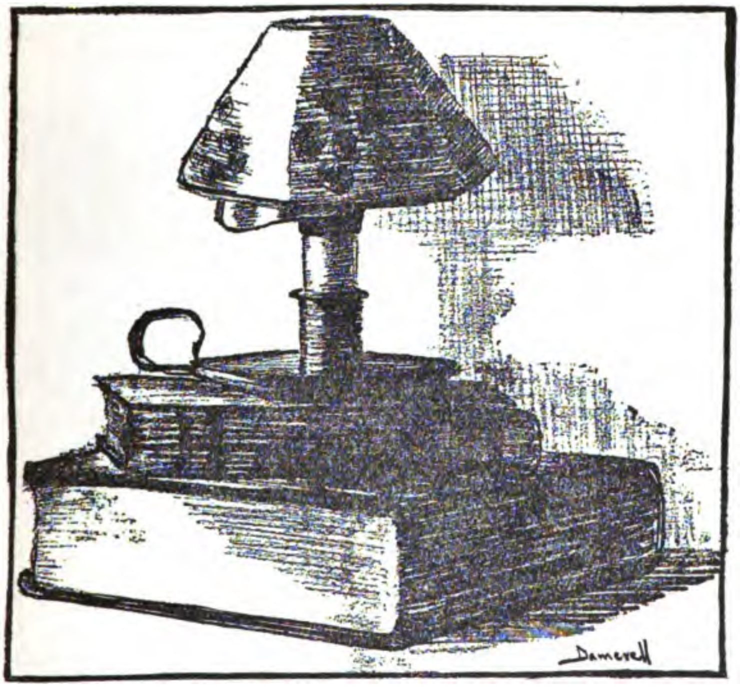
slightly converging with these base lines, making the farther vertical edges a little shorter than the front vertical edge. Notice the position of the farther corner and the shape of the top face. Sketch lightly with tentative lines, until the drawing looks right.

Make several experiments with the cube placed in different positions, and draw what you see. After studying it turned at an angle below the line of the eye, look at it a little above the eye level, and draw again.

42. Third Week. RECTANGULAR OBJECTS (CONTINUED). (1) *Cube* (Continued). It will take some time for the pupils

to gain a working knowledge of the principles of perspective; to help them to visualize the appearance of the cube placed at any angle, the teacher may suggest the different positions by partly sketching the cube on the board, and asking the pupils to hold their cubes in the position indicated by the lines drawn. Ask them to finish the sketch by observing how the other lines should be drawn. Practice on this until the pupils can draw the cube in any position. Heavy lines indicate the lines to be drawn on the board. See illustration.

(2) *House.* In the next lesson apply these principles by drawing a house in perspective. The teacher should draw



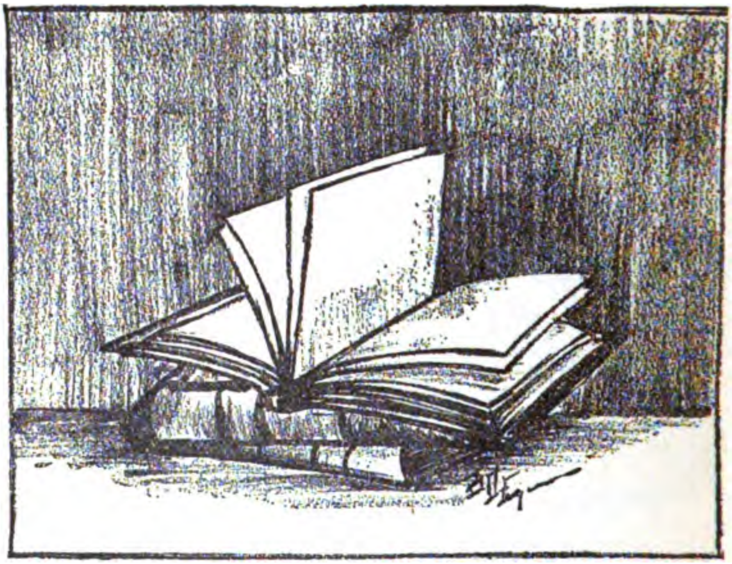
GROUP OF RECTANGULAR OBJECTS IN PERSPECTIVE

a sketch of the house on the blackboard, commencing with the vertical corner nearest to the observer. Then indicate the farther corners, showing the amount of foreshortening

observed in the sides of the house, and the length of the corners compared with the first corner drawn. Place the gable by finding the center, shown by drawing diagonal lines at the end and erecting a vertical line. Remember the lines at the eaves and roof will slant downward a little, while the lines at the ground will slant slightly up toward the horizon, or level of the eye.

The birthplace of George Washington would be an appropriate sketch to make this week; also the old log cabin which is so familiar to us as the birthplace of Lincoln.

43. Fourth Week. (a) RECTANGULAR OBJECTS (CONTINUED). Continue drawing rectangular objects, including boxes, books, tables and other common objects. Use pencils or colored crayons.



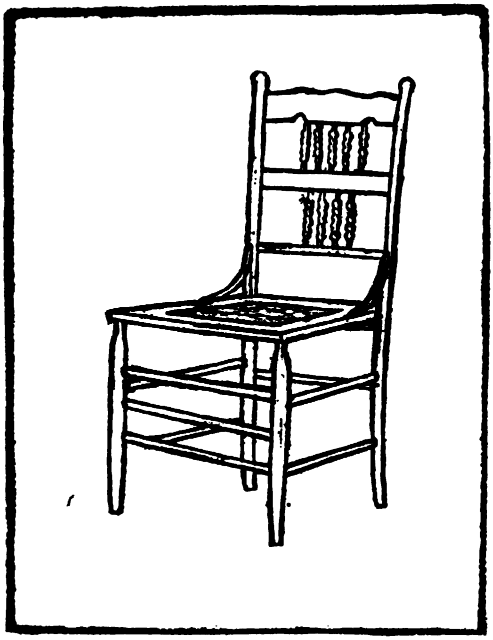
BOOKS IN PERSPECTIVE

Place the objects to be studied on boards between the desks, and call the pupils' attention to their position. Are the objects seen in parallel or in angular perspective? Hold

the ruler out and notice the angles made by the receding edges of the object with the ruler, as it appears to touch the lower edge of the object. Finders made of a piece of cardboard, or paper, and shaped like a carpenter's square, may be held to show the exact angle made by any receding line. Hold one arm of the finder vertical, and let the other follow the base lines of the object.

Try drawing a single book in different positions; then try a group of books, a candlestick or a piece of pottery. See the illustration of books.

If the view from the schoolroom window gives an opportunity to try sketching houses, a part of the week might be taken up in so doing, or the teacher may sketch a winter landscape on the blackboard, and the pupils may make sketches from this.


CHAIR IN PERSPECTIVE

(b) Review. Review and reiterate the principles learned this month in observing the appearance of rectangular objects. Give the pupils the following principles and ask them to write and learn them:

(1) The apparent width from front to back of any horizontal face decreases as it approaches the level of the eye.

(2) The farther of two edges horizontal from left to right appears shorter than the nearer.

(3) All parallel horizontal edges receding from the eye appear to converge.

(4) All receding horizontal edges appear to incline toward the level of the eye, and must be drawn so that, if produced, they will meet in a point on the level of the eye.

This month's work deals with some prosaic facts in object drawing, but upon these truths more interesting work will be developed. It has been well observed that "Nobody really knows about any subject until its length, breadth and height are equal in clearness in his mind." This is particularly true of the subject of perspective.

Test. Make a drawing of the chalk box facing below the level of the eye. Make a drawing of this box turned at an angle, below the level of the eye. Make a drawing of a group of two books in angular perspective.

Write the principles involved in drawing objects in parallel and angular perspective.

MARCH

We love best when we see them painted
Things we have passed a hundred times
Nor cared to see,
And so they are better painted,
Better for you and me.

—*Browning.*

44. First Week. REPRESENTATION. During January and February the pupils have been learning something of the alphabet of form and the principles governing its representation. Let them continue their drawing of objects for a few weeks in order that they may express in terms of beauty some of the common forms about them.

You have studied the single object with considerable care. Now consider the grouping of objects, placing two or more together in a way that they may illustrate a thought—in other words, tell a story.

(1) *Grouping.* In making a group, determine first the idea to be expressed, thus leading to the selection of objects having harmonious relations, that is, objects that seem to

belong together. For example, objects to be found in the kitchen can be placed together, but objects from the kitchen are not to be grouped with parlor bric-a-brac.

(2) *Composition.* One of the most important elements in representation is that of composition. This element enters into all representation, whether of single objects or a group of objects. In the single object it is a question of proper placing, or composing, in the space on the paper upon which it is to be represented. In grouping, the first thought is to have the objects well arranged or composed so as to make a pleasing whole. Unity is the great law of good arrangement or composition. Ruskin defines composition as "the help of everything in the picture by everything else.

(3) *Arrangement of a Group.* Learn the essentials of good arrangement by placing objects together. Have for use in the lesson several pieces of pottery used in previous lessons, and some vegetables—potatoes, onions or squashes. Think of the objects that would be associated together in preparing these vegetables. Choose a pot, a pan or a basket for the potatoes or onions, and arrange them together as they might look on the kitchen table.

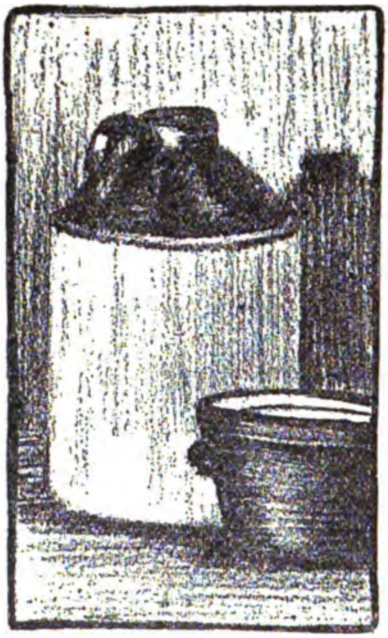
Place the potatoes with an object by themselves, the onions with another; then place them beside the pan, but not directly in front of it, thereby concealing the whole base of the pan.

Place one vegetable a little behind another. This gives us a variety. Compare this arrangement with that obtained by placing the objects in a row, or at random. If the squash is used, a larger object would be most suitable to place with it. A jug placed beside the squash, or partly back of it, would suggest a cellar group.

Try representing a group arranged on boards between the aisles, using pencil and manila or white drawing paper. Sketch in light, blocking-in lines, and be careful to place the object which is nearest you in a lower portion on the paper than the object farther away. Then compare the light and shade sides of the objects, and show the shading on the

vegetables with slanting strokes. See illustrations, including Color Plate Five.

Try grouping two pottery forms together, choosing those that are varied in form and have interesting color contrasts. For instance, a tall jar with a shorter one; a dark jug with a light one; a pitcher and cup or bowl placed together; a teapot with cup and saucer, jug, bowl, etc. Select objects of interest around the schoolhouse; for instance, the coal pail, some sticks of wood, fire tongs, poker, and the water pail and dipper make interesting studies.



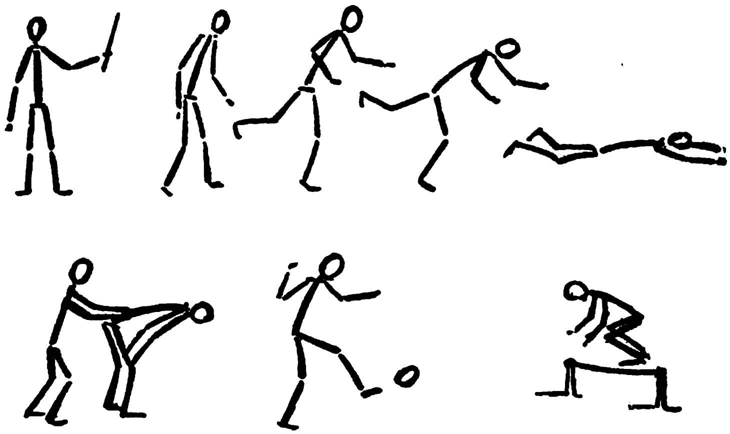
STUDY IN GROUPING

In a good group, the principal object is placed near the center. The secondary objects should be arranged so that their bases will not be in a straight line, or in a direct line with the base of the principal object. Arrange them so that a partial view of some object is seen, and try to have a variety in position; but make the objects seem to belong together and to be at rest. Do not leave too great a space between them. A good group gives one a feeling of repose and harmony, and if boundary lines were drawn about it, they would form an irregular figure, usually a triangle.

45. Second Week. REPRESENTATION (CONTINUED). Last week cylindrical objects were used in grouping; try rectangular objects this week. Use the material available in the schoolroom, such as chalk boxes and books. Various sizes of books can be used to give variety to the groups.

What can you place with a chalk box to make an interesting group? Something appropriate would be two or three pieces of chalk and an eraser. Arrange them to make a pleasing group. Draw in outline and complete in light and shade. If a group of books is chosen, two or three arranged carelessly together will afford an excellent problem in perspective.

To assist the children to see the appearance of receding edges, direct them to cut out two right angles from a piece of cardboard or stiff paper. By holding these in front of a group, the amount of slant is quickly seen. The pupils



POSES IN OUTLINE

will receive considerable assistance in getting a correct idea of the foreshortened faces of the top of the books by sticking pins vertically in their faces near the corners, then comparing the placing of the distant corners and edges with the height of these pins.

Another method of determining the foreshortening is to measure with the ruler held upright, allowing the top of the ruler to touch the highest point in the group, and the thumb to slide down to show the lowest point, then compare that measurement with the whole length of the group. Of course, these measurements must be made with the same

existing proportions in your study. For instance, if the books appear three inches high and five inches long, then these measurements, or those bearing the same ratio, must be used in the drawing. We may enlarge the drawing, or reduce it, by multiplying or dividing the original measurement by the same number.

The dictionary and teacher's bell will make an interesting group, and a dinner box with a cup will make another. Other groups of interest would be a candlestick with books and the globe with books.

46. Third Week. THE HUMAN FIGURE. In some schools where a thorough course in drawing in the primary grades has laid the foundation upon which to build, the work in object drawing might be continued, and advanced problems like a corner of the school room, an open door, a chair or the teacher's desk could well be studied during the remainder of the month. See illustrations. But if the children have not had much previous work, it will not be well to continue object drawing to the exclusion of many interesting exercises which may be included in the spring work.

Though March is such a variable month, before this time there will be some signs of the awakening of new life—the return of a few birds, the swelling buds and the exuberant activity of the children, who will be anxious to try the spring games of marbles, flying kites, jumping rope, playing ball, and other pastimes. Utilize these natural activities in connection with a study of the human figure. It will be well to review the simple action lines, or skeleton figures, preliminary to working from the figure.

Choose one of the smaller boys to pose, and ask him to stand on a chair, or table, where all can see him. Observe the upright figure. Can you draw one line to express this position? (*Answer:* A vertical line.) Compare this with a prostrate figure, which may be shown with a horizontal line. Now compare parts of the figure, trunk, limbs and head. By measurement you will discover the relative proportion of the parts of the body, the trunk and head forming the

upper half, and the lower limbs the lower half of the figure.

Draw a small circle for the head and straight lines to express the trunk and limbs, leaving a small open space at the knees and elbows.

FIGURE POSING

Ask a boy to walk across the floor, then to run; observe the change in direction of trunk and limbs.

Try representing the figure in action, using straight lines. After representing the skeleton figures, showing walking and running, illustrate jumping, pulling and pushing poses, until the pupils can show quickly, with a few lines, the action of the figure. See the illustration, page 333.

Follow these exercises with a study of the figure in mass, making a silhouette in ink or black water color, which will show the shape of the figure. See the illustration.

Let the boy take some position for decided action, as the position of a boy with a bat, or stooping to catch a ball, or aiming with a gun (using a pointer for a gun). Form a group by having two boys pose for playing leap-frog.

Use brush and ink to show the direction the trunk and limbs take, then fill in, working from the center to the outer edge to get the shape of the figure. Show the position of the head, body and limbs in simple mass effect. See the illustrations.

47. Fourth Week. FIGURE WORK (CONTINUED). After showing the figure in mass effect, try expressing the pose in

STUDY IN CHARCOAL

pencil outline, which is a little more difficult, but also more explicit.

Vary the work by allowing one of the girls to pose; if she wears a hat and coat and carries an umbrella it will make an interesting pose. Use blocking in lines as before, and place the center of the figure, waist line, etc. Sketch in light, loose, tentative lines at first, getting the relative placing of the parts before making firm lines for the finished sketch.

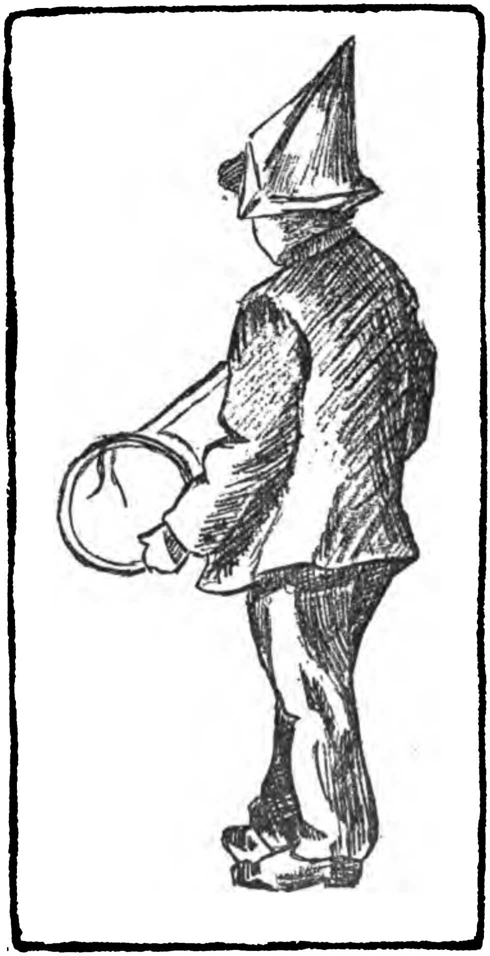


FIGURE POSING

If possible, use some idea developed in reading to suggest interesting poses. A Puritan figure can be quickly shown by using white paper cap, collar and cuffs, with a white apron. If the figure is represented as reading, we have a very good Priscilla. Try to show the dark parts of the dress by pencil painting, leaving the white parts the color of the paper.

The children will soon become interested in making each

other's pictures, and often some real talent in figure drawing will be discovered. See the illustrations.

In connection with the study of the figure, try to show the children some of the great masters' work in figure painting. Jean Francois Millet, the French peasant painter, has shown us how simply treated some of the great themes of farm life may be. *The Sower*, *The Peasant*, *Grafting a Tree*, *The Shepherdess*, *Knitting*, *Bringing Home the New Born Calf*, and others, make us feel the simplicity and poetry of the life around us.

Test. Make a drawing of a group of objects found in the schoolroom illustrating both cylindrical and rectangular perspective.

Name three essentials in good grouping.

Make a drawing of a child posing, illustrating some game, such as playing ball or marbles.

APRIL

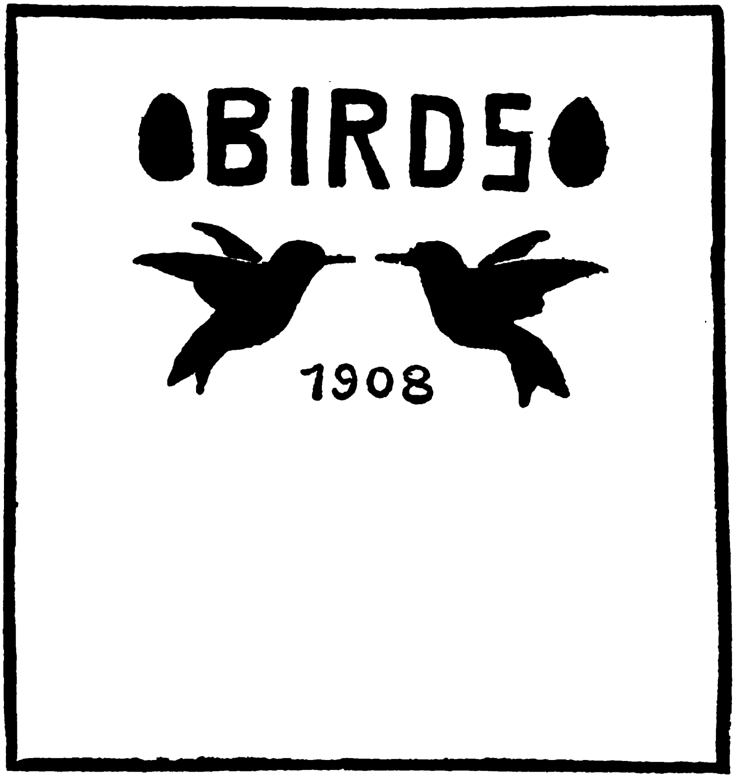
Come children, dance and sing
For spring is here.
The crust of earth is breaking,
The flowers are all awaking.
Come, dance and sing.

48. First Week. BIRD STUDY. To enumerate the joys of life in the spring is to suggest abundant material for art study. The return of the birds, the new growth of the buds, the first flowers, the spring landscape, the animal life, spring gardening, are all fruitful sources for observation and expression.

Have you kept a record of the return of the birds this past month? (See page 31, Section 37.) Have you seen the robin, the blue jay, the blue bird and the flicker? Do you have the bird pictures in the schoolroom? Outline bird studies for children to color, published by the Davis Press, Worcester, Mass., are helpful.

From bird pictures and observations from nature, try painting or drawing pictures of the birds named above. The color adds great interest, and if water color is used, paint

the body of the bird egg-shaped, then add the head, tail and wings. If a written record of observations is kept, a cover for the bird booklet would be a good problem. Try



COVER FOR BIRD BOOK

using the bird motif in a decorative way for the booklet cover, making a symmetrical unit instead of a mere picture of a bird. See the illustration.

49. Second Week. ANIMAL STUDIES. Besides the birds, the rabbit and chickens make interesting studies at this time. Ask the children to bring some of their pets to school, and after a few lessons from the animals indoors, encourage the children to sketch from the animals at home.

(1) *The Rabbit.* The rabbit makes one of the best subjects in animal study, because it is so gentle. It may be brought to school in a basket and placed on the table for study during the lesson period; or, better still, have a box in which it may be kept and allowed to remain several days. The easiest way to express the animal form is by the use of ink and brush. Make a silhouette to show the shape of the body, head and other prominent parts. Second, try sketching in outline with a pencil. Third, show spotting by pencil painting.

ANIMAL STUDY

The proportion of the body, and the relative size of the head to the body, should be carefully studied, and blocking-in lines should be used to express these proportions.

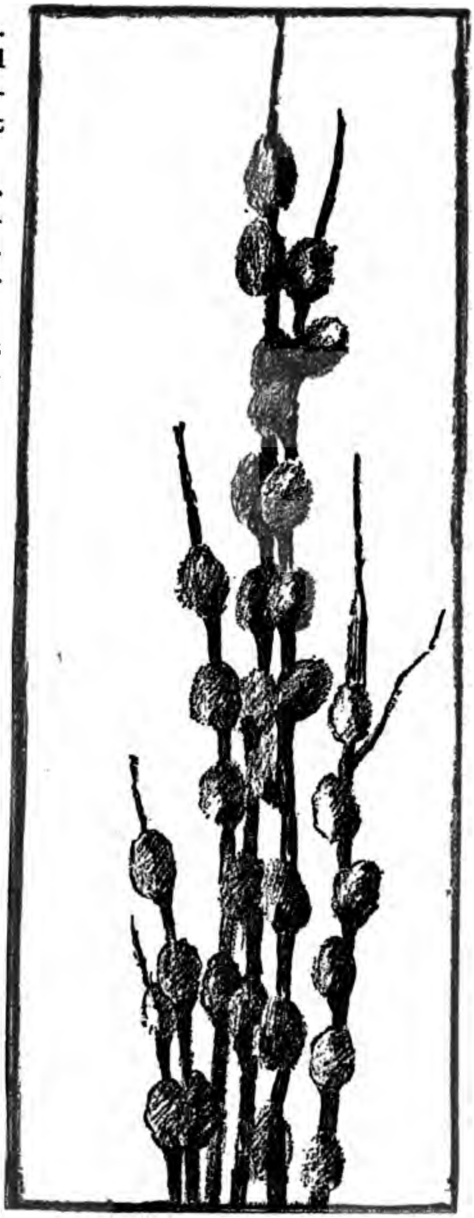
The rabbit makes an excellent subject for a lesson in clay modeling. Soften the clay by soaking in water, then placing it in a cloth bag, and working it to the consistency of putty. First, make a ball-shaped body, then the head and ears, and press them into position. Shape all the parts from the one piece of clay, instead of making the details in separate pieces and putting them on. Allow the clay models to be dried, and then, when desired, they may be soaked up again for another lesson in clay modeling.

(2) *The Chicken.* A rooster or a pet hen makes a fine subject for a lesson. It may be wise to have the bird in a cage, unless it is very tame. Use the same process as outlined before. Make a mass painting first with brush and ink, getting a silhouette; then try with pencils or crayon.

50. Third Week. ANIMAL STUDY (CONTINUED). Ask the children to bring other pets to school—a gentle dog or cat; in the country even a lamb might be attempted. If the animal moves frequently, try making snap shots, as it were,

working from memory. Silhouette work and outline drawing in pencil will be the best methods to employ.

51. Fourth Week. (a) Easter Decorations. Choose something appropriate for an Easter sentiment, and plan to print it carefully. In the upper grades an appropriate decoration can be added, using a conventionalized flower. The Easter lily, crocus, spring anemone or the daffodil will be most suitable. Print a simple, straight-line alphabet on the board, and after the children have chosen their text, let them plan with rulers the space for the letters. They should place lines at the top and bottom of each row of letters, divide the long space into small spaces for each letter, then place each letter in its space, leaving a small space between the letters and longer spaces between the words.



The Alder by the river
Shakes out its powdery curls
The Willow buds in silver
For little boys and girls."

Here are some appropriate texts:

May Joy be Yours,
This Easter-tide.

O the glory of the spring-time
Making all things bright and new!
O the rosy eve's surrender
To the Easter moonlight tender.
—*Havergal.*

Within, above, and all around
The chimes of deep cathedral bells
An early herald peal that tells
A glorious Easter-tide begun.
—*Havergal.*

In planning a decoration for the sentiment, plan a border space, dividing it also into spaces. With paper and scissors, make a little flower shape that will fill the small space. Place this pattern in each square space into which the border is divided, and trace around it. Paint the border in appropriate color, to suggest spring; green and

white, purple and green, or pink and green are suitable colors. Outline the design in black, using a fine brush and ink or black water color. See Color Plate Six.

This week's work may be taken at the time most suggestive of the Easter day. More elaborate designs for Easter thought may be worked out if the children have had some previous work in designing. If preferred, an appropriate text simply bearing on spring may be chosen instead of the special Easter thought.

(b) MEMORY DRAWINGS. Memory drawing should be encouraged frequently in other lines of work, instead of always depending on the object; then the mind would be accustomed to retaining the image, and greater working power would be the result.

Test. Make a drawing from two tree branches having buds. Use a pencil. Make a cover for a nature booklet. Print the words, "Nature Booklet," and make a border, using bird or flower motif. (Use ink or black water color.)

MAY

Robins in the tree top,
Blossoms in the grass,
Green things a-growing
Everywhere you pass.
Sudden little breezes,
Showers of silver dew,
Black bough and bent twig
Budding out anew.
Pine tree and willow tree
Tinged elm and larch,
Don't you think that May-time's
Pleasanter than March?

—*Thomas Bailey Aldrich.*

52. First Week. SPRING FLOWERS. Do you know the spring flowers as they appear? The trailing arbutus in the northern woods, the pussy willows, now to catkins grown, the hepatica, the anemone, the spring beauty, the wake-robin, Jack-in-the-pulpit, dogwood blossoms, violets and buttercups in the woods and fields, and in our gardens the tulips, iris and

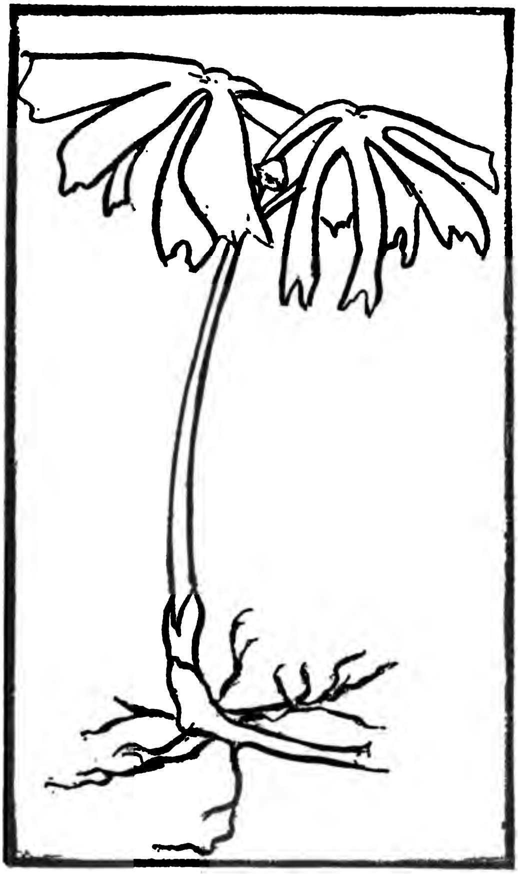
firebush all make delightful studies. Besides the birds, buds and trees, the brooks are teeming with wonderful lessons of

MAGNOLIA

life. The water bugs, fishes, frogs and frog's eggs and tadpoles and a stray tortoise can be collected to make a school aquarium. All of this material will serve in its turn not alone as interesting material for nature study but for art subjects, as well.

Choose the large, single flowers, like dogwood blossoms, tulips, Jack-in-the-pulpit and magnolia, rather than the small, intricate flowers, like the violet, the anemone and the hepatica.

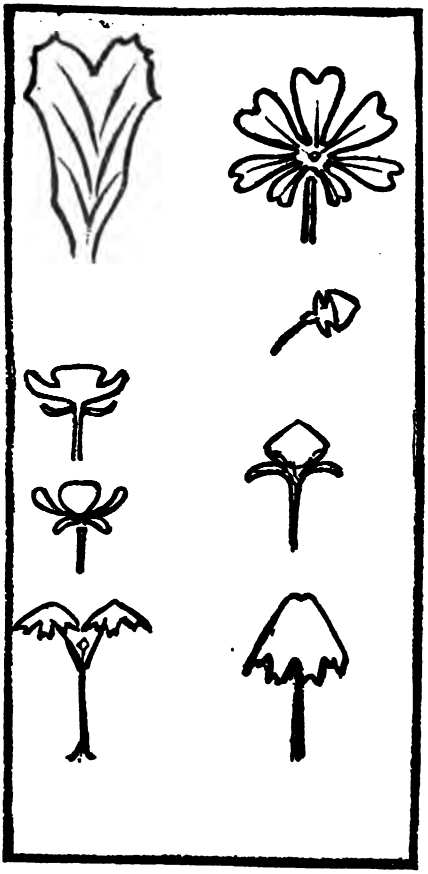
Fasten the study chosen to a cardboard easel, and place this on boards between the front desks. Study the plan of growth, the arrangement of leaves, whether alternate or opposite, the position of the flower, whether at the end of the stem or in the axil of the leaf. Observe carefully the amount of foreshortening in the flower and leaf, and show by light, blocking-in lines the direction of the stem and the position of the various parts. Represent the color effect by pencil painting. See the illustration.



DESIGN FROM MANDRAKE

53. Second Week. FLOWERS OR TREE BUDS IN COLOR. The same flowers used last week may be chosen, or others may be selected. Use water colors and manila paper, if flowers are chosen, and colored crayons, if tree buds are studied.

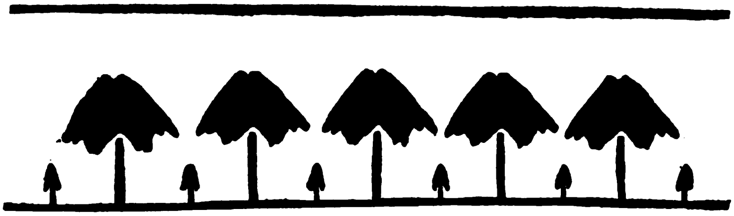
Study the color and form of the subject, and practice mixing colors to match the flowers and leaves, if water color is the medium. Have the pupils practice on paper, to gain freedom in handling the brush and color. Express slender stems by holding the brush upright. Press on the brush to obtain breadth of stroke for the leaves. Work in mass effect; do not outline the flower and leaves and then fill in, but work from the center out. Commence with the part of the study, flowers or leaves that you find at the top, and work down to the bottom, expressing leaves and stems as you come to them. See Color Plates Seven and Eight.



DESIGN UNITS FROM MANDRAKE

Try several flower studies in this way, or vary the week's work by using tree buds expressed in water color or colored crayon. The waxy horse chestnut, the popular catkins and others may be used as soon as they

appear. Let these lessons be given when the nature material is in season.



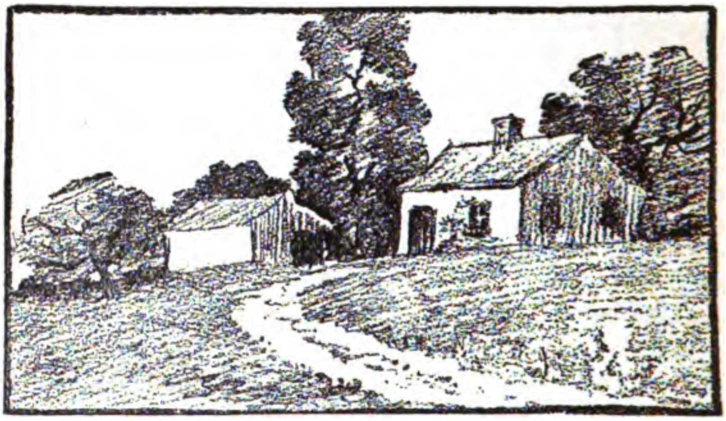
BORDER DESIGN FROM MANDRAKE

54. Third Week. SPRING BOOKLET. The last two weeks can be very profitably devoted to written exercises pertaining to spring. The nature walks and talks will make very profitable material for subject matter for writing lessons, and the art work will illustrate these very acceptably. Plan to make a cover for the booklet of exercises, and use some appropriate nature unit, either insect or flower, for the design. If the flowers are used, select one which is simple, like the marsh marigold, trillium or Jack-in-the-pulpit.

Analyze the flower to see the underlying plan and

the number and shape of the petals. Draw the top and side view of the flower in outline. The top view will give a radial arrangement, called a rosette, while the side view gives a bi-symmetric unit, based on a center line.

Plan the units to make a border or a surface pattern, leaving space for the printing of the name and date. After



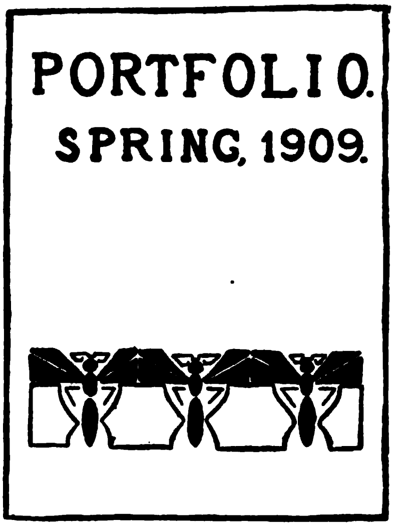
SPRING LANDSCAPE

the outline of the design is drawn, paint the same in water colors or ink, or use colored crayons. See the illustration.

Plan the printing carefully, drawing lines with the ruler at the top and bottom of the letters, and then spacing off the letters, making them with straight lines. Paint with ink, or water color which will harmonize with the design. The paper used in this exercise may be manila, but the colored papers, or bogus paper, are to be preferred. Fasten the papers in the cover with a cord.

55. Fourth Week. SPRING LANDSCAPES. To aid the children in choosing good subjects for landscape study, draw a long stretch of horizon, including several trees, perhaps a house or two, on the blackboard, and show the children how to use a finder by folding or cutting two right angles of paper and holding them to make a little frame, through which they may choose a small section of the landscape

drawn. See illustration, page 351. Draw the part selected on manila paper, and show by pencil painting the color of the trees and the ground. Follow this lesson in copying from the blackboard by a sketch from out of doors, either window observations or a memory sketch.



The Bartholomew and the Woodbury *Pencil Sketches from Nature* make very helpful studies for the children to copy at this time. They are inexpensive (25 cents per set of six), and can be obtained of the Prang Educational Company, Chicago.

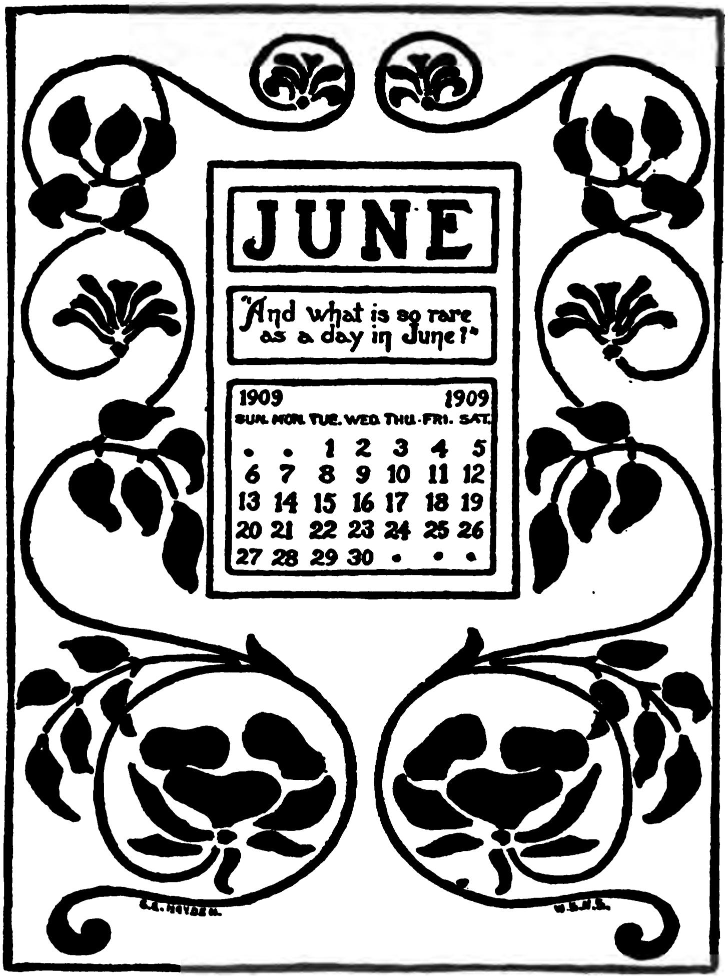
Test. (a) Draw in outline a spring plant—a tulip or other large flower. (b) Make a painting from a flower study, using water colors or ink.

JUNE

Look without!
  Behold the beauty of the day; the shout
Of color to glad color, rocks and trees
And sun and sea, and wind and sky!
    All these
Are God's expression, art work of his hand
Which men must love, ere they can understand.
—*Richard Hovey.*

56. First Week. SPRING LANDSCAPES (CONTINUED). The children have attempted to represent the landscape in pencil painting during the last week. Let them try this week to express the beauty of color in sky and tree and ground—possibly a stream, or pond, which will reflect the glory of the sky.

Paint in the color of the sky, after putting a water wash over the paper, and then paint the green for meadow or lawn.



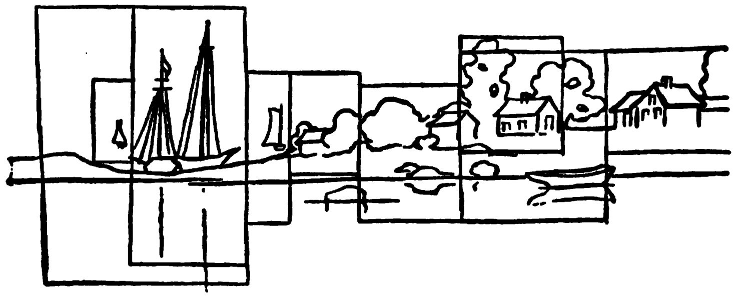
After practicing the shape of the trees on a dry piece of paper, paint the trees in mass to suggest the particular trees they may be studying. Possibly the peach or apple trees in bloom

are chosen; if so, paint the delicate pink blossoms first and then add the green.

The teacher may again sketch a long stretch of horizon on the board, showing perhaps the elements spoken of in the poem, "the sky and sea" and "rocks and trees;" let the children choose a composition from it with their finders, and then draw the principal forms very lightly before painting. See the illustration below.

Try several simple color impressions representing different times of day by different color schemes in sky and water. A sunset, an afternoon or a morning scene may be represented.

57. Second Week. DECORATIVE LANDSCAPE. When the landscape is used to decorate a book cover or magazine, it is rendered in a purely decorative way, which means that



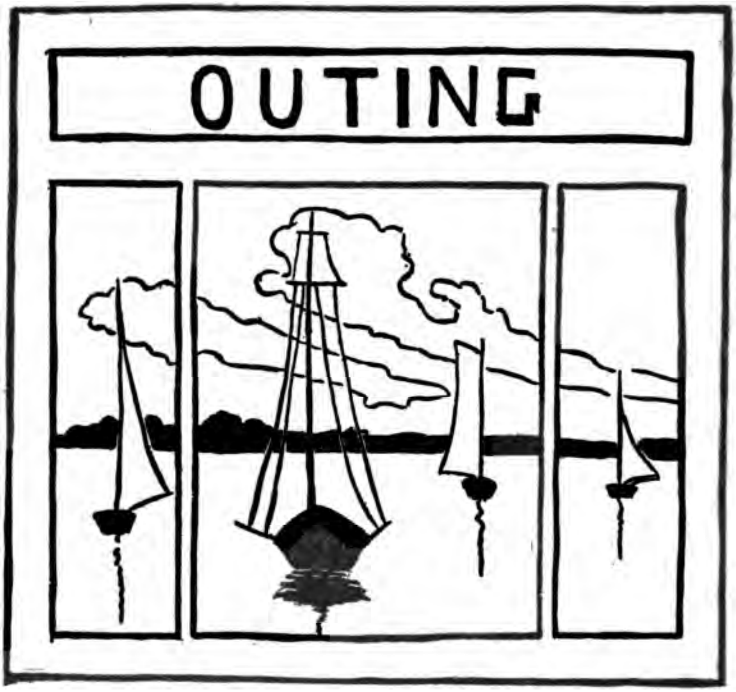
HORIZON STUDY, ILLUSTRATING USE OF FINDERS

the various elements are drawn carefully and the color is applied in a flat wash. Use either black and white and gray, or color, using tones of one color, like light and dark green, or blue, or a combination of a few colors, always mixing the colors to produce a gray.

Draw the landscape composition carefully, using a motif from the blackboard sketch previously made. After the drawing is made, decide which parts of the landscape should be light and which dark. With a little ink or black water color mixed with water, apply the tone for the sky, then a darker color for the ground, and a very dark color for the trees, using more ink or water color where the darkest color is desired.

Try this lesson first with black and gray, then with tones of one color, as green or blue, using light and dark tones, as in the previous study.

58. Third Week. APPLICATION OF DECORATIVE LANDSCAPE. A portfolio or envelope in which the term's drawings



DECORATIVE LANDSCAPE

may be kept will make a fitting problem to close the year's work.

The pattern for the envelope was given in September work (see page 283, Section 21). If the portfolio is desired, the following materials are necessary: Two pieces of cardboard 12 x 14 inches; a piece of toweling 16 x 28 inches, or bogus paper, for covering. The paste may be either library or flour paste.

Paste a strip of paper or cloth between the two pieces of cardboard, to form the back of the portfolio, allowing a space of an inch between them. Cloth is better than paper, because it makes a stouter back. Any cotton cloth will be satisfactory. Cut the covering (bogus paper or toweling) large enough to cover the two halves of the portfolio, and leave an inch to spare all around, to fold over as a lap. The

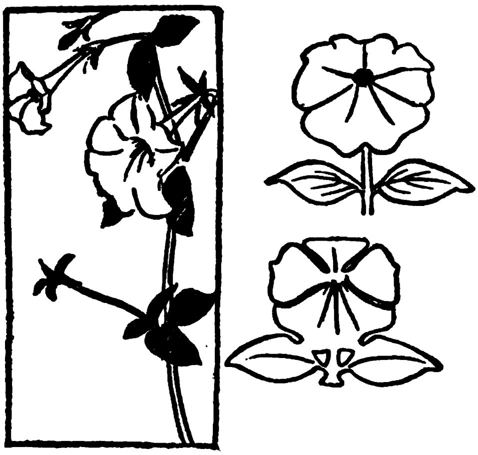
DESIGN FOR BOOK COVER

covering may be pasted down flat on the boards, or it may be creased and the lap only pasted down.

The lining paper should cover the inside up to within a half inch of the edge, and should be pasted all over to insure its being flat. Manila paper will serve very well for a lining. An extra strip should be pasted down the back before the lining is pasted on the inside of the covers.

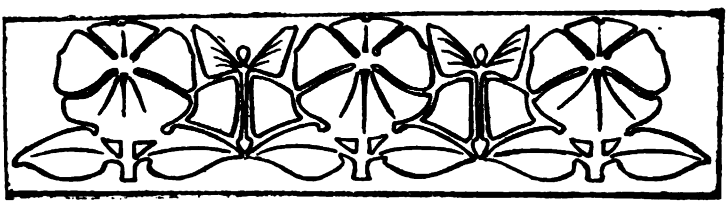
Decorate the portfolio with the decorative landscape previously drawn. Paint it in black or tones of one color. If the toweling has been used for the cover, use a little paste with the colors to prevent them from spreading.

The word *Drawings* or *Portfolio* might be added to the decoration. Great care should be used in planning the letters, drawing a line at the top and bottom, and spacing the letters equally. Use plain block letters.



DESIGN FROM PETUNIA

Instead of a decorative landscape, a conventionalized flower in a border might be used across the front cover of the portfolio. Choose some simple flower form, like the tulip or petunia (see the illustration), and draw the outline of form and cut a paper pattern of this unit, which may be traced around to make a design on the cover. Plan the space to be decorated. Commence in the center to place the pattern, and use as many units as the space will permit.



CONVENTIONALIZED DESIGN FROM PETUNIA

59. Optional Problems. The whole month of June may be used in making and decorating something useful for the

PLATE ONE

PLATE TWO


NOVEMBER
-1909-
S -•- 7 14 21 28
M - 1 8 15 22 29
T - 2 9 16 23 30
W - 3 10 17 24 -•-
T - 4 11 18 25 -•-
F - 5 12 19 26 -•-
S - 6 13 20 27 -•-
NOVEMBER WOODS ARE
BARE AND STILL
NOVEMBER DAYS ARE
CLEAR AND BRIGHT.

PLATE THREE

PLATE FOUR

PLATE FIVE

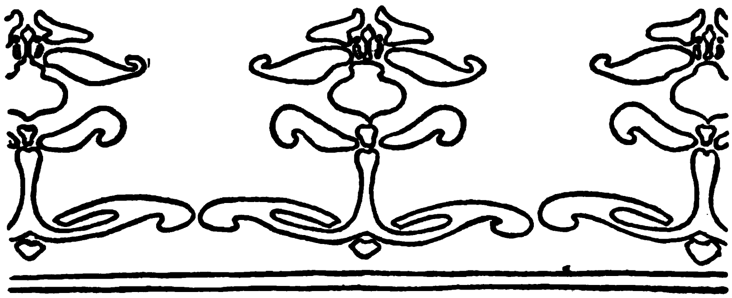

EASTER
Rejoice! Rejoice! the robins
Trill; Be glad! the breezes
Flutter "'Tis Easter day!"
Each bright sunray
In dancing seems to utter
Farewell to darkened day
And cold for all life's
Gray has turned to gold!

PLATE SIX

PLATE SEVEN

PLATE EIGHT

home. Pillow covers or curtains may be stenciled, using a conventionalized flower motif in a design. After the flower has been chosen and studied carefully, have the pupils make a careful drawing, or painting, as the flower studied may suggest. They should take one flower and make a careful drawing of the top, or front view, leaving an open center and the petals separated to suggest a stenciled design, as the



MAGNOLIA DESIGN FOR BORDER

magnolia design in the border herewith reproduced suggests. Such a border would make a very appropriate design to use as a stencil on curtains or a pillow.

Let the final work of the year be a problem which includes the application of art to something both useful and beautiful for the home. In this way fine art will become useful art, and the useful arts become fine arts.

Test. Make a design suitable for a curtain, using some flower motif. Paint the design in two colors or in ink.

Of what value is art training in the home and in the school?

PICTURE STUDY

60. Selection of Pictures. The use of pictures to illumine all the work of the schoolroom needs no discussion at this period of educational advancement to prove its value. It is often only the question of what pictures are available to illustrate the reading, geography, history, nature and art study, and where they may be obtained, that the enterprising teacher is asking.

A request for a catalogue from any of the following houses will give the teacher much valuable information: Perry Pictures Co., Tremont Temple, Boston, Mass.; Cosmos Pictures Co., 296 Broadway, New York; George P. Brown & Co., 38 Lovett St., Beverly, Mass. Pictures appropriate for use in teaching history and geography are completely listed under the heading of the names of the different countries in each of these catalogues, so that a list here is unnecessary.

Besides the pictures used merely to illustrate other subjects, there should be added the study of some of the great masterpieces in painting and sculpture, and the inexpensive reproductions of these famous works of art are the best means afforded to become acquainted with them. If one or two new pictures were presented to the children every month, they would know a representative collection at the end of the eighth year.

The following list has been chosen from the penny pictures, and grouped as in the catalogues, under the head of the different countries, so that they may be easily found by consulting the catalogues. The classification is not made according to grades, as the teacher often finds pupils in upper grammar grades who are unacquainted with the most commonly known works of art.

The teacher will choose those pictures she thinks will be most interesting to her pupils. The pictures of animals, country life and activities, figures, landscapes and historical subjects are, in the order enumerated, interesting to children. Some of the pictures will be found especially helpful to use in connection with the lessons in landscape and figure work; notable among these are the Corot pictures in the former, and Millet pictures in the latter case. Some of the pictures, especially those of Madonnas, are most appropriate for study at the Christmas season. Others will be helpful to the work in history. This is particularly true of some of the works of Italian artists.

61. Method of Study. (1) Allow the children to enjoy the pictures without much discussion on the part of the

teacher, then by a few questions lead them more fully to appreciate the message the artist intended to convey.

(2) Learn something of the life of the artist and the century in which he worked.

(3) If the picture is a landscape, study it to get the character of the country, time of the year, mood of the day, or characteristics of the trees or sky or ground which the artist wished to reveal. Can you tell the time of day by the color contrasts, that is, by the effects of dark and light, or the length of the shadows?

(4) If the subject is a figure, study to see the message or story it contains. Does it tell of work or play, or is it a portrait which expresses well the individual characteristics of the sitter?

(5) Do not fail to speak of the beauty or strength of line in the figures, the placing of the figures in the landscape setting, the simplicity of environment, the naturalness of pose, and the national characteristics in dress and feature.

62. Helps. For helps along the line of picture study, try to obtain copies of the works of Estelle Hurll, who has written interestingly on many of the great artists; also Mrs. Wilson's *Picture Study.* If possible, obtain back numbers of the *Perry Magazine. How to Enjoy Pictures* by Mabel Emery, and any of Russell Sturgis' books on art topics are very valuable.

63. Lists for Reference. (a) American Artists. Stuart, portraits of *George Washington* and *Martha Washington;* Boughton, *Pilgrims Going to Church, John Alden and Priscilla;* Blashfield, *Christmas Chimes;* Abbott Thayer, *Caritas* (*Charity*)*;* Sargent, *Frieze in Boston Library.*

(b) English Artists. Turner, *The Fighting Temeraire, Venice, Wreck of the Minotaur;* Millais, *The Princess in the Tower;* Burne-Jones, *The Golden Stair;* George F. Watts, *Sir Galahad;* Rossetti, *Dante's Dream, The Blessed Damosel;* Landseer, *Highland Shepherd's Chief Mourner, Dignity and Impudence, Member of the Humane Society, The Deer Pass, The Connoisseur.*

(c) French Artists. Rosa Bonheur, *The Horse Fair, Coming from the Fair, Ploughing, Cattle in Brittany, Landais Peasants, Scotch Cattle;* Troyon, *Return to the Farm, Oxen Going to Work, Landscape*

with Sheep; Millet, *The Sower, The Gleaners, The Angelus, Going to Work, Sheep Shearing, Potato Planting, Shepherdess Knitting;* Julien Dupre, *Haymakers' Rest, Pitching Hay, Before the Storm;* Corot, *Dance of the Nymphs, Lake Albano, The Lake, Landscape with Willows.*

(d) DUTCH ARTISTS. Rembrandt, *The Night Watch, The Anatomical Lesson, Rembrandt's Mother, Saskia* (his wife); Mauve, *Shepherd and His Flock, The Returning Sheep.*

(e) FLEMISH ARTISTS. Van Dyck, *Children of Charles I;* Rubens, *Portrait of Himself, Descent from the Cross:* Alma-Tadema, *Reading from Homer.*

(f) GERMAN ARTISTS. Schreyer, *Arabs on the March, Arabian Outposts, A Halt in the Oasis;* Hofmann, *Christ in the Temple, Christ and the Rich Young Man, St. Cecelia;* Holbein, *Madonna of the Burgomaster Meyer, Martin Luther, Luther's Wife;* Durer, *Portrait of Himself, Adoration of the Magi.*

(g) ITALIAN ARTISTS. Michelangelo, *David, Moses, The Fates;* Raphael, *Sistine Madonna, Transfiguration;* Botticelli, *Allegory of Spring;* Leonardo da Vinci, *Mona Lisa, The Last Supper.*

(h) SPANISH ARTISTS. Velasquez, *Portrait of Himself, Portrait of Philip IV;* Murillo, *The Madonna and Child, Immaculate Conception, The Melon Eaters.*

(j) GREEK SCULPTURE. *The Parthenon; Venus de Milo; Hermes,* by Praxiteles; *The Fates* (from the Parthenon); *Victory of Samothrace; The Wrestlers.*

LESSON TWENTY

DOMESTIC SCIENCE

INTRODUCTION

1. Why Domestic Science Should be Taught. The home should be an earthly paradise, the haven where, after the day's toil, the members of the family can find rest and peace; a bower of beauty in which the young receive their first ideas of refinement; the abode of love, where each shares the other's joys and sorrows, where high ideals are formed and evil passions suppressed; the center around which clusters all that is best and noblest in life. Whatever the public school can do to make the home more attractive and to bring it nearer a state of perfection should be considered a part of its legitimate work. Among the reasons for placing domestic science in the course of study of public schools, the following are important:

(a) Growth of Cities. Recent changes in our industrial system have in many instances compelled us to adopt new methods of living to which our former practices are not well suited. The development of the large corporation has brought people into centers of population until over one-third of the inhabitants of the United States now live in the cities of eight thousand or more population.

(b) New Home Conditions. Formerly the home was the center of many lines of industry. The women of the household not only prepared and cooked the food and cared for the house; they also spun the yarn, wove the cloth and cut and made the garments for the family. A girl who reached her twentieth year without becoming skilful in these various occupations was not considered to be adequately prepared for the duties of life. Now all this is changed; practically everything can be obtained from the factory and the store ready for use, while in towns bakeshops supply all varieties of cooked food. The women of the household

have given their attention to other affairs, and the old accomplishments are greatly neglected.

(c) Prevention of Waste. It has been said that the family of a French peasant could live well upon the material which many an American housewife throws into the garbage can. No other nation is so wasteful of the material from which food, raiment and shelter are supplied. Much of this waste is due to ignorance, and some of it to carelessness. Girls should be taught the value of the raw materials and the manufactured articles used in our daily sustenance, and the knowledge thus gained will prevent much of the waste now so common.

(d) Reduction of Living Expenses. Within the last few years living expenses have increased to such an extent that many families find it difficult to supply their actual needs from their incomes, and the housewife does not know how to reduce expenses and still maintain the standard of living. A more thorough knowledge of the properties and value of the various kinds of raw material from which food is obtained, and of fabrics from which garments are made, constitutes an important step in the solution of this perplexing problem.

(e) Connection of the School with the Home. Girls of the intermediate and grammar grades have strong domestic proclivities, and they are easily interested in whatever pertains to the welfare of the home. Lessons in domestic science which are within their mental grasp enable them to make such a connection between the school and the home as will increase their interest in both their school work and their home duties.

2. Difficulties. The teacher who wishes to give her girls lessons in domestic science in most schools finds herself face to face with numerous difficulties. Among the most prominent of these, the following may be mentioned:

(a) Lack of Knowledge. Only a small number of teachers have as yet made any definite preparation for teaching this branch, though most teachers have some practical

Photograph by Edgar C. Pruitt.

DOMESTIC SCIENCE IN RURAL SCHOOLS

Showing basement of Cottage Hill School, Sangamon County, Illinois, fitted for dining room for pupils.

knowledge of how to conduct a home. Such teachers should use this knowledge as a foundation upon which to build, and by study, reading and experiment obtain the preparation necessary for the work.

(b) Lack of Time. This is often a more serious difficulty than the first, for in nearly every school the curriculum is overcrowded. However, wise planning will do much to overcome this difficulty. Many of the nature study lessons and the lessons in elementary science can be so directed as to contribute to lessons on domestic science. This is especially true of those lessons upon articles from which food, clothing and shelter are obtained. Again, many of the principles of cooking are so closely allied with physics and chemistry that some of the lessons upon these subjects will contribute knowledge which can be applied in domestic science. The greatest difficulty is that of providing two lines of work, one for the boys and another for the girls, and finding time to supervise both. But the teacher must remember that these lessons should not be given daily, where the curriculum is already full. By alternating domestic science with other branches, considerable can be accomplished in a year's time even with a crowded course of study.

(c) Lack of Conveniences. It is only in the larger towns and in cities that we find school buildings fitted up for manual training and domestic science. Lack of space, lack of funds, and, too often, lack of interest on the part of patrons and school officials, compel the teacher of the rural school and the small graded school to depend upon her own resources if she wishes to carry on this work. If the schoolhouse has a basement, and the consent of the directors and coöperation of the pupils can be secured, this can be turned into a domestic science and manual training room. The accompanying photograph shows what one teacher in a rural school in Illinois accomplished in this way. Pupils will often bring from home utensils which can be spared; they will also contribute more or less of the material. Nothing succeeds like success, and when the work is once

started, much of the indifference in the community will disappear, and under new conditions which you have created most of the material needed can be obtained.

3. What to Attempt. The kind and amount of work will depend largely upon local conditions, and no definite outline can well be given. In general, the lessons should be upon the essentials, those principles and practices which everyone who manages a home must know. The lessons should also be elementary in character, and in difficulty they should be kept within the capacity of the pupils; there should also be enough variety in the work to sustain interest. Lessons on foods and cooking, on the care of the home, and on sewing and knitting, if rightly interspersed, will afford this variety.

FOODS

4. Preparation of the Teacher. The teacher needs a far more extensive knowledge of foods and foodstuffs than she will ever be called upon to impart to her pupils. The scope of this lesson admits of only an outline of what that knowledge should consist. Further information must be obtained through observation and the study of a few of the many books available at slight cost.

The object of providing food should be understood, namely, to supply the system with proper nourishment; and the knowledge of what constitutes proper nourishment is essential to this understanding. This question being answered, the next query is what articles of food contain these different substances in the proper proportion. From these questions we at once see that a knowledge of the principles of nutrition and the chemical composition of the various articles of food, and how these articles should be cooked, are essential to the successful teaching of this subject. To the theoretical knowledge gained from study, the teacher should add such practical skill as will enable her to illustrate by experiment and practice all the principles and laws discussed in the lesson. She should be able to do well whatever she recommends her pupils to do.

The teacher who is lacking in this preparation should not, however, be discouraged. There are many plain, practical books on domestic science which are now available, and the experiments required to illustrate the lessons are so simple that a little practice will enable anyone to perform them with success.

5. Classification of Foods. All substances used for food can be divided into three classes—compounds containing nitrogen, compounds which do not contain nitrogen, and minerals. To the first division the general name *protein* is applied. The compounds of the second division are divided into two classes—hydrocarbons, or compounds of hydrogen and carbon with some oxygen, of which fats and oils are good representatives, and carbohydrates, or compounds containing carbon, hydrogen and oxygen, and having the hydrogen and oxygen in proportions to form water. Starch and sugar are good representatives of this class. The minerals are water, potash, lime, soda, phosphorus, iron, sulphur, chlorine, and a few others of less importance. Water is the most abundant substance in the human system, constituting about three-fourths of the weight of the body, but the other minerals exist only in very small quantities.

6. Protein. Protein includes all nitrogenous foods, and the term is now used in the place of proteid, albumin, albuminoids and nitrogenous foods; and these terms, wherever found in works on chemistry or domestic science, the student should understand to mean the same as protein.

Proteins are divided into three classes—albumins or albuminoids, gelatin or gelatinoids, and extractives. Albumin occurs in the white of eggs, from which it takes its name, the serum of blood, lean meat, the casein of milk, and the gluten of wheat. All of these substances are indispensable to life. Albumin contains a large proportion of nitrogen, and it is employed in building the new tissue in the period of growth and in repairing waste after the system reaches maturity. It also contributes somewhat to the heat of the body. Albumin is soluble in water and weak solutions of

salt. Heat coagulates it, as may be shown by dropping the white of an egg into water and gradually bringing the water to a temperature of 180°.

Gluten can be obtained from wheat flour by placing a small quantity of flour (about two ounces) in a bag of cheesecloth or thin muslin, and kneading the flour under running water. The starch is washed out through the pores in the cloth, leaving a stringy, sticky, yellowish substance. This is the gluten and contains albumin. Gluten is also found in barley and other cereals. It occurs in peas and beans in a substance somewhat resembling the gluten of wheat, but of a darker color.

Gelatin is found in cartilage, bone, ligaments and tendons. Whenever meat containing a large proportion of these tissues is boiled for a long time, the liquor, on cooling, forms a jelly, due to the extracted gelatin. Gelatin contains more nitrogen than albumen, but it is not as nutritious; however, it is easily digested, and on this account is often used in various forms as food for invalids.

Extractives include the juices extracted from meat by soaking it in water, as in the process of making beef tea. They contain nitrogen and perform important functions in nutrition, but, contrary to the general belief, they do not directly contribute to the nourishment of the body; they give flavor to meat, and their presence seems essential to the digestion of muscular fiber. The old idea that beef tea and other extracts of beef are nutritious has doubtless led to death by starvation in many cases. Repeated experiments have shown that gelatin, the juices and fibers of meat, are all necessary to nutrition. This should be remembered whenever meat extracts are recommended for convalescents.

7. Fats. Fats, like protein, are of both animal and vegetable origin. There is practically no distinction between fat and oil. Fat is solidified oil, and oil is melted fat; either can be changed to the other by raising or lowering the temperature to the necessary point. Adipose tissue is formed by an accumulation of fat cells. It is found in largest quan-

tities under the skin, around the viscera, and around the kidneys. Natural fats, as butter, tallow and lard, are composed of a number of fatty acids united with glycerine. Vegetable fats are also composed of several substances, but at ordinary temperatures they retain their liquid form, as in olive oil, castor oil and linseed oil.

Fat contains seventy-nine parts carbon, eleven parts hydrogen and about ten parts oxygen. The small quantity of oxygen is insufficient to oxydize even the hydrogen in the compound. Because of its large proportion of carbon, fat is the most important heat producer among the foods. It also serves to supply nourishment in cases of disease, deprivation of the ordinary supply of food, and of great exertion. In all such instances, the fat is absorbed and the person becomes more or less emaciated. The fat in the body is a storehouse of energy to be drawn upon in a case of need.

8. Starch. The carbohydrates form one of the largest classes of food stuffs, and one of the most important and most widely distributed of these is starch, which occurs to a greater or less extent in all roots, bulbs, grains and other seeds used as food. To detect the presence of starch in any article of food, obtain from a drug store a little tincture of iodine. Greatly reduce this, then moisten the substance to be tested and place a drop of the dilute tincture upon it; if starch is present the iodine will color the substance blue. Starch consists of minute granules which take various forms in different substances, but which to the naked eye appear as a formless white powder. It is insoluble in cold water, but soluble in hot water, forming a sticky paste. The human stomach cannot digest raw starch; therefore, foodstuffs containing it in any amount need to be cooked.

When starch is heated to 320° or 400°, according to the amount of water it contains, it is changed into a translucent substance closely resembling gum arabic, and known as *dextrin*, or British gum. Dextrin is soluble in water and is digestible; it is formed from cooked starch, when that is acted upon by saliva during mastication.

9. Sugar. Sugar is found in the sap of plants, in ripe fruits, in milk and in a number of other substances. Its chief commercial sources are sugar cane, some varieties of beet and sugar maple. Unlike starch, sugar is soluble to a limited extent in cold water, and to a much greater extent in hot water. As a food, sugar is both a fat former and a source of energy. It is used in many forms, all of which are too well known to need description. In the process of digestion some starch is changed to sugar at the same time that other portions are changed to dextrin. The action producing this change, as already stated, is begun by the saliva during the process of mastication. All carbohydrates are transformed into *dextros*, a form of sugar, during digestion.

10. Mineral Foods. The minerals in the human system exist in the form of salts and acids; that is, the lime, soda, potash, phosphorus and other minerals are not found in their pure state, but in some compound containing an acid and of which they constitute an important ingredient; as, chlorine and sodium are found in common salt; calcium, the basis of lime, in phosphate of lime, and so on. Likewise, these minerals are obtained from eating substances containing compounds of which they form a part. When animal bodies are burned these minerals are found in the ash.

While the minerals found in the system exist only in small quantities, their presence is essential to the maintenance of health and life; hence, in planning the food for the individual or family, care should be taken to see that such selections are made as will supply the system with these substances.

Certain acids found in fruit and vegetables are also essential to the healthy condition of the blood. Chief among these are oxalic, tartaric, citric and malic acids. Since these are all found in vegetable compounds, they are known as vegetable acids. Malic acid is found in apples; oxalic in tomatoes and rhubarb, and citric acid in oranges, lemons and other fruits of the citron family. Green vegetables and fruits

are eaten more for the salts and acids which they contain than for the direct nourishment derived from them.

11. Water. As already stated, water constitutes a larger proportion of the human system than any other substance; there is no organ or tissue that does not contain it, and some tissues are nearly nine-tenths water. Water for household purposes is obtained from springs, streams, wells and lakes, and contains lime and other salts in solution. Water containing a perceptible quantity of lime is known as "hard;" that is, it does not readily yield to soap. Sulphur, iron and magnesia are often detected by the taste they impart to the water. Unless these minerals exist in excess, they are not injurious; but organic impurities, caused by the presence of decaying animal or vegetable matter, are often the cause of typhoid fever, diphtheria and other dangerous diseases. Everyone should know how to test water for organic impurities. Either of the following simple tests can be made by anyone:

(1) Into a vial containing about two ounces of water put a quantity of granulated sugar equal in volume to a pea or small bean. When the sugar is dissolved, cork the vial and set it in a warm place for forty-eight hours. If, when the cork is removed, the water emits a disagreeable odor, it is unsafe.

(2) Make a solution of permanganate of potash by dropping into an ounce of water a few crystals of this substance, which can be obtained at any drug store. Into a glass of the suspected water place a few drops of the solution. If the purple color disappears, the water is unsafe.

While these tests are practical and safe, it is of course much more satisfactory to have the water analyzed by a chemist, when this can be done. It is of the utmost importance to have pure drinking water, and in order that this may be secured the source of the supply should be chosen with the greatest care and be kept free from contamination. This topic will be further considered under household economics.

12. Food Values. In determining the value of any foodstuff, several items must be considered, such as the amount of heat it produces; the amount of nutriment it contains; its digestibility, and the facility with which is can be absorbed. If these requisites were known for each article of food purchased, the housewife would often make different selections and in so doing improve the diet, at the same time reducing the expense of her household. As an illustration of this let us note that the most expensive cuts of meat, as the tenderloin and sirloin in beef, contain less nutriment than some of the cheaper cuts, as the breast and flank. When these latter are properly cooked, therefore, they furnish more nutriment at less expense. Again, coarse breads are better foods for children and those leading sedentary lives than bread made from the finest white flour.

In general, vegetable food contains more nutriment for the system as a whole than meat. The latter, however, furnishes its nutriment in a more concentrated form and is more stimulating, so that a well-balanced menu should contain both animal and vegetable foods, with a preponderance of the latter.

COOKING

13. Purposes. Fruits, nuts, honey, some oils and a few vegetables, as the tomato and the melons, are valuable for food in their raw state, but most of the foodstuffs are far more digestible and nutritious when cooked; therefore, one of the chief purposes of cooking is to change the conditions of food so that the digestive juices can act upon it more readily. A second purpose is to make the food more appetizing by improving its flavor or appearance, or both. The appetizing influence of proper cooking and serving is never overlooked by the good cook in the home or by the *chef* in the hotel or restaurant. A third and very important purpose is to kill any germs, parasites or other organisms contained in the food which might otherwise produce disease, such as trichinosis, from eating raw ham, and typhoid fever, from drinking water contaminated by organic impurities.

14. Applications. Keeping in mind the facts, principles and purposes discussed in the previous pages, the teacher should give her class such lessons as will enable them to put these into practice. In general, lessons in cooking should be confined to the older girls, seldom including those below the sixth grade, and when the class includes girls of various ages and attainments the teacher may find it necessary to provide one set of exercises for the older girls and another for the younger. Be this as it may, all should receive such instruction and training as will make them conversant with those underlying facts and principles necessary to success in all cooking. The following sections indicate lines of work which are useful and practical and which can be carried on with success in any school where domestic science can be introduced. Each suggestion should be elaborated by the teacher as the capacity of her class and the time and conveniences may indicate. So far as possible, pupils should use the same material as most of them will use in cooking at home; whenever stoves or ranges are provided, these should be adapted to the kind of fuel in most general use in the community, whether it be wood, hard coal, soft coal or gas. The advantages and disadvantages of each kind of fuel and the cost of the same should be discussed with the class. Each pupil should make a study of the range in her home and be able to tell how to manage its dampers and checks. If she can draw a diagram of the range, showing the position of each damper and flue, and the directions which the currents of air take in passing through these, it will add much interest to the exercise.

15. Applications of Heat. All cooking is accomplished through the agency of heat. Heat is transmitted in three ways: by conduction, as when an iron rod is heated through its entire length by placing one end of it in the fire; by radiation, as when a room is warmed by a stove and the earth by the sun; by convection, as when heat is transmitted by the movement of a fluid in a vessel, such as water or air. All three methods of transmission are used in cooking.

Roasting and baking, for instance, employ radiation; in boiling, convection is used, and in nearly all cases heat is transmitted by conduction from the surface to the interior of the article to be cooked.

Heat may be used directly, as in boiling and roasting, or indirectly, as when it is transmitted through a liquid. Whatever the method of transmission, the temperature should never exceed the point necessary to cook the article. For instance, eggs are cooked at 180° Fahrenheit. A temperature of 212°, that of boiling water, is not only unnecessary but injurious. Many articles of food are injured, if not spoiled, by being cooked at too high a temperature; but this will be better understood as we study the different methods of applying heat in cooking the various articles of food.

16. Milk. Milk is the natural food of the young of all mammalia, and many adults among the human species derive a good portion of their nourishment from it. While the milk of goats and camels is used in a few countries, in the United States cow's milk exclusively is used. The average of a large number of analyses of cow's milk give the following result, which may be stated in the terms of either A or B in the table:

CONSTITUENTS OF MILK

A—PARTS		B—PERCENT	
Water	874	Water	87
Fat	40	Minerals	1
Sugar and soluble salts	50	Fat	4
Nitrogenous compounds and soluble salts	36	Casein	3
		Sugar	5
Total	1000	Total	100

The substances found in milk contain a large class of foods in which are protein, carbohydrates and hydrocarbons. The fat exists in minute globules, which rise to the surface and constitute the cream. By agitation, as in churning,

these globules are shaken free from the curdy envelope and unite to form butter.

EXPERIMENTS. (1) Procure a quart of fresh milk; put it in a glass can and set it in a cool place until the cream rises. How deep is the layer of cream? From this measurement estimate the relative proportion of milk and cream. Do these ever vary?

(2) Place the cream in a glass fruit can, fasten on the cover and shake the can until butter is formed. What proportion of the cream is buttermilk? This exercise affords a lesson in butter making as well as in determining the amount of fat in the milk. The pupils should be shown how the buttermilk is worked out of butter, and also taught the necessary amount of salt to use for the flavoring and preservation of the butter. On however large a scale butter is manufactured, the process and principles here applied are those always used.

(3) Allow the milk from which the cream has been taken to sour. Collect the curd in a bag of cheesecloth or thin muslin, and drain out the whey, allowing it to run into the can from which the curd was taken. What proportion of the milk is whey? What proportion curd? For what can the curd be used? The answer to this question should lead to interesting experiments by the pupils in making an appetizing article of food from sour-milk curd.

(4) Discuss with the class the sources of contamination which endanger milk. Lead them to realize the importance of keeping milk pure and teach them how this can be done. Send to the Department of Agriculture, Washington, D. C., for Farmers' Bulletin No. 3, *Care of Milk on the Farm*; it will furnish the necessary information for this exercise.

(5) Explain the various methods of preserving milk. What is pasteurized milk?

(6) Both raw and cooked milk are used for food. Learn from the members of the class all the different ways which they know of using milk in cooking. This will enable you to give such exercises in cooking milk as you think are most

needed. Become conversant with the changes which take place in cooking milk. Some of these changes promote, others retard, digestion. Some people who cannot digest raw milk readily can digest it when cooked. Cooking coagulates the albumin, and since this is accomplished at a temperature ranging from 145° to 180°, milk should not be raised above the latter temperature in cooking. Boiling causes the fat globules to collect in masses, solidifies the albumin and causes other changes, all of which render the milk indigestible. Apply this principle in making white sauces, creamed soups and other articles of food in which milk is an ingredient.

Milk is one of the least expensive and also the most valuable articles of diet, and the pupils should become skilful in cooking the various dishes into which it enters.

17. Eggs. The composition of eggs is similar to that of milk. They contain less water, more fat and more albumin. Like milk, they form a wholesome and nutritious food, and, except for a short time in the winter, they are less expensive than meat. They also enter into very many combinations in cooking.

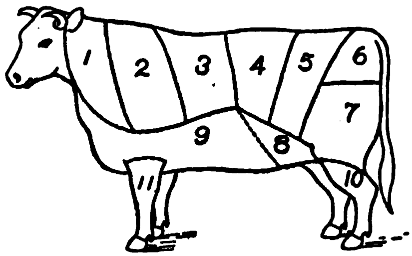
Exercises. (1) Procure a number of eggs and experiment in cooking them. First, drop one into boiling water and let it remain for three minutes. Drop another into water that has been brought to the boiling point, remove the dish from the stove and let the egg remain in the water for twelve or fifteen minutes. Which do you consider the more easily digested? Place one in water heated to 180° and allow it to remain ten minutes, taking care to keep the water at this temperature. How does this egg compare with those cooked by the other methods? Which method do you consider the best, and why?

The above experiments show that eggs and milk require about the same temperature for cooking, namely, 180°, whether cooked separately or combined as in scrambled eggs.

(2) Obtain from each member of the class all the different uses of eggs which she knows, and let this knowledge guide

you in preparing exercises on the use of eggs in cooking. These exercises should include the cooking of dishes in which eggs are combined with less expensive articles of food, the use of eggs in the various doughs into which they enter, also in clarifying coffee, soups, etc. The class should be led to appreciate the full value of eggs as an inexpensive and nutritious article of diet. Procure from the Department of Agriculture, Washington, D. C., Farmers' Bulletin No. 128, *Eggs and Their Uses as Food.* This will give you much valuable information which can be used in conducting these exercises.

18. Meats. Meats form the most expensive part of the daily food of the average American family. Muscle fiber, or lean meat, is the most nutritious and the most highly prized. Therefore, cuts which contain the largest proportion of lean meat are more expensive than those containing a large proportion of fat, gristle and bone. The most expensive cuts are those containing the largest proportion of the tender muscle fiber. These are from the loin and rump. You should become familiar with the different cuts and their relative value, before giving lessons on meats.

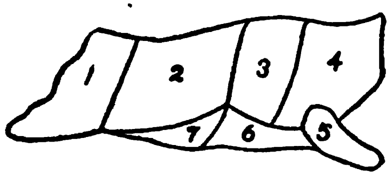


CUTS OF BEEF, RETAIL (CHICAGO METHOD)

1, neck; 2, chuck; 3, prime of rib; 4, porterhouse; 5, sirloin; 6, rump; 7, round; 8, flank; 9, plate; 10, shank; 11, shin.

Lean meat contains fibrin, gelatin and albumin. The purposes of cooking meat are to make the fiber more tender, to improve the flavor and to liberate the juices. In preparing exercises upon cooking meats, particular attention should be given to the cooking of the inexpensive cuts, many of which are more nutritious than those of a higher price. The processes described below pertain to those meats, poultry and fish which are in general use:

(a) BROILING. In broiling, the heat is transmitted by radiation. This is the simplest method of cooking and is employed in cooking tender cuts of meats, as steaks, cutlets and chops, and sometimes in cooking fish. At the beginning the heat should be sufficiently intense to coagulate the albumin on the surface and thus form a water-tight coating over the meat, which will keep the juices from escaping. After this coating is formed, the temperature should be lowered to the point necessary for cooking the fiber. What kind of fire is best suited to broiling? Why? What meats can be broiled to advantage?



CUTS OF BEEF, WHOLESALE (CHICAGO METHOD)

1, round; 2, loin; 3, rib; 4, chuck; 5, shank; 6, plate; 7, loin.

(b) ROASTING. Originally, roasting differed from broiling only in the size of the cut to be cooked, but now roasting is practically synonymous with baking. The cut is placed in an oven and surrounded by hot air instead of being placed before the fire, where only one side is affected by the heat and frequent turning is necessary. The same principle applies in roasting as in broiling. At the beginning the heat should be sufficient to form a coating on the surface of the meat, which will prevent the escape of the juices, then the temperature should be reduced to the lowest point at which the meat can be cooked, that is from 180° to 190°. What is the purpose of basting the roast during the process of cooking?

(c) FRYING. In frying, the article to be cooked should be immersed in hot fat, but a very common method is to fry the article in a pan whose bottom has been covered with fat. The first method is better because the other is more wasteful of fat, and because it does not preserve the juices of the meat or fish as well, consequently, the flavor is not so good as when the article is immersed in hot fat. What kinds of meat are usually cooked by frying? What fish are usually fried?

Practical lessons in frying are easily given, if the pupils have the use of a stove. Provide a small kettle of fat and a frying-pan. To test the value of the two methods, take two chops or two fishes and prepare them in the same way; immerse one in fat and fry the other in the pan, and compare results.

(d) BOILING. Boiling differs from frying only in the liquid used. In each case hot liquid is employed to convey the heat to the object to be cooked; in the one we use water, in the other fat. The meat or fish should be immersed in boiling water for the same reason that it should be placed in a hot oven, that is, to prevent the juices from escaping. When an impervious coating has been formed, the temperature should be reduced until the water barely simmers. Meats cooked at a temperature considerably below the boiling point are more satisfactory, but this low temperature requires a longer time. It is to this fact that the success of the so-called "fireless cooker" is due. The water is brought to the boiling point and the kettle then enclosed in a box so constructed that it is a non-conductor of heat; in consequence, the water remains for several hours at a temperature above that required to cook meat.

Whatever the method employed, fresh meat cooked at a low temperature has a better flavor and is more easily digested than that cooked at a higher temperature.

(e) SOUPS. In making soups and broths it is desirable to extract from the meat all the juices possible. For this reason the meat should be cut into small pieces and placed in cold water, which is slowly brought to the boiling point. This fact should be thoroughly understood by the pupils, since some of the cheaper cuts of meat are used to the best advantage in making soups.

(f) EXPERIMENTS. (1) Ascertain what each member of the class knows about the different meats—beef, mutton, pork, veal and lamb. Place the diagrams shown on pages 373 and 374 upon the board, or reproduce them upon a chart large enough to be seen by all the class, and have the pupils learn the different cuts.

(2) Give the pupils an exercise in picking out these different cuts in the market. Doubtless you can secure the coöperation of the butcher in this work.

(3) Have the class learn the best methods of cooking the different cuts of each kind of meat, also what kind of meat should be well cooked and what may be partially cooked.

(4) Treat poultry and fish upon the same plan as that given for treating meats.

19. Starchy Foods. Starchy foods include all those containing starch, whether in their natural or prepared state. Most of them also contain sugar and some other ingredients, especially vegetable acids. The starchy foods used in their natural state, that is, without being mixed with other ingredients, are roots, tubers, stems, leaves, fruits and seeds, the last being used mostly in the dry state. All of these substances contain more or less wood fiber, which has no food value because it is indigestible. Skins of fruit, husks, cobs and pods are discarded because they cannot be digested. Some of the wood fiber found in the parts of plants used for food can often be removed by chopping and straining, but a considerable portion of it remains in the food, and one of the purposes of cooking is to soften this so that it will not irritate the alimentary tract.

The nature of starch and the method of testing for it have already been described (Section 8). All vegetables contain more or less starch, and the second important purpose in cooking them is to make the starch soluble, therefore digestible.

(a) VEGETABLES. The precautions regarding temperature in cooking milk, eggs and meat need not be observed in cooking vegetables. Most of them cook better at a temperature above that of boiling water, and their value as food is increased by thorough cooking. Some vegetables, like the potato and squash, contain enough water to cook themselves, and are usually of better flavor when baked, or, if boiled, when placed in just enough water to cover

them. Most other vegetables are cooked by boiling. A tight cover to the kettle increases the pressure upon the surface of the water, thus raising the boiling point slightly above 212°, and is therefore an advantage. Dried seeds, such as beans and peas, should be soaked until they swell to about twice their size, before cooking. The best results are obtained by cooking them slowly and for several hours.

Why are butter, cream, milk and fat added to vegetables? What are the advantages of knowing a variety of ways of cooking the same vegetable? What vegetables are most extensively used as food?

In connection with this topic pupils should be given such exercises as will enable them to prepare wholesome, nutritious articles of food from combinations of vegetables with milk, eggs, meat and flour, respectively. What these exercises will be must be determined by the teacher, for they will vary with different classes. Vegetables, when properly cooked and combined with milk, eggs and flour, can often take the place of meat, and thus the housewife is able to reduce expenses.

(b) DOUGHS. The cereals, wheat, corn, rye, oats and barley, are generally used in the form of flour or meal, though the so-called cereal foods, or breakfast foods, are prepared from some of these grains in a variety of forms. Before cooking, flour is mixed with water or milk, forming a paste to which the name *dough* is generally applied. It is in the preparation of the very large variety of articles of food of which dough forms a part that we find displayed some of the rarest skill of the culinary art. To young girls the cooking of fancy articles usually appeals with greater force than the cooking of those substantial articles which constitute the greater part of our daily sustenance. The teacher should remember that the knowledge of cooking the substantial foods is of vastly greater importance, and her exercises in connection with this topic should give the necessary practice in cooking these articles. It is more necessary that the pupils know how to make bread than desserts. If the class

has a range at its disposal, practice in cooking all the common articles prepared from flour and meal should be given. These lessons can be interspersed with those on cooking eggs, milk, meat and vegetables, and thus monotony in the exercises can be prevented.

20. Other Exercises. The foregoing sections have outlined exercises upon those topics which are of vital importance in the art of cooking, but the limitations of this work make it impossible to give a complete list of the lessons which should be given; neither is this necessary. To the live teacher suggestion is better than a fully developed plan. Lessons on pastry, drinks, salads and numerous other topics will naturally follow the lessons outlined above. The extent to which they can be carried will depend upon the time that can be devoted to the subject and to the age and experience of the pupils, but something should be done along each of these lines.

HOUSEHOLD ECONOMICS

21. Sanitation. It is not the province of the lessons on household economics which are given in the public schools to discuss the location or the construction of dwellings, but there are certain matters pertaining to the sanitary condition of the home that the pupils should be taught. These lessons on sanitation are equally important and should be of equal interest to both boys and girls. The lessons should include the following subjects:

(a) OUTBUILDINGS. Many people live in houses which have been built by others, and in selecting the location of a house or flat, one should give attention to the proximity of stables, earth closets and other buildings whose presence may contaminate the air with nauseating odors. Such odors are caused by gases, all of which are liable to produce disease.

(b) DRAINAGE. Stagnant water near a house is also a menace to health, and its presence is evidence of defective drainage or lack of drainage altogether. If located where there is no sewage system, the house should be provided

with a drain for carrying off waste water, which should never be thrown upon the ground near the house. The water-closets should also be connected with this drain, which should be constructed of tile, having the joints made airtight and the tile laid in clay. The opening of the drain should not be within at least two hundred and fifty feet of the house and a greater distance is preferable. Any breakage or other defect in a drain should be repaired at once, since it allows the escape of exceedingly injurious sewer gas.

(c) WATER SUPPLY. We have already referred (Section 11) to the importance of pure water, and in selecting a home the water supply is one of the most vital factors to be considered. In cities and most large towns, water is supplied through a city water system whose source is usually a river or lake. If this source is selected with proper care and the grounds immediately surrounding it are so safeguarded that the water will not be contaminated by surface water flowing in during heavy rains, it is usually safe. Private sources of water supply are springs and wells, and these are liable to contamination from two sources—surface water flowing into them during rains, and water entering beneath the surface that has soaked into the ground from barnyards, water-closets and other places where waste water has been thrown. If examined in a glass, this water as it enters the spring or well appears pure, but when subjected to the tests given in Section 11, it shows the presence of organic impurities. Much sickness and doubtless some deaths are caused from water contaminated in this way. The ground around the mouth of a well or spring should be so guarded that surface water cannot flow in. Deep wells are safer than shallow wells, because the water in them is not so liable to be contaminated. In every instance the well should be lined its entire depth with cement, so that water cannot enter through the walls. Barns and outhouses should be located below the wells or springs from which water is taken for drinking and cooking purposes.

(d) PLUMBING. Defective plumbing is a prevalent source of disease. Teach the pupils how traps are constructed, their purpose, and how they can be cleaned. Plumbing should be open, so that any defect can be detected at once. There should be as little of it as possible, and the simpler the plan upon which it is arranged, the better.

(e) WARMING AND VENTILATION. Whatever method of heating is used, its advantages and disadvantages should be discussed. This will make necessary on the part of the teacher a knowledge of heating by hot water, steam, furnace and stoves. If all these systems are in use in the locality, there should be a discussion of the best methods of managing each. The older boys will probably be able to contribute considerable to this discussion.

Pure air is essential to health; simple methods of ventilating dwellings should be explained and illustrated. Emphasis should also be placed upon the necessity of giving the house a thorough airing each day in winter.

(f) REMOVING DUST. Dust contains particles of effete matter from the breath, the skin and other sources. Whenever there is dust in the air, such impurities as these are inhaled; therefore, its presence in dwellings and public buildings is a menace to health. Discuss the necessity of keeping the house free from dust, and the best methods of removing it.

(g) INSECT PESTS. Every housekeeper is more or less annoyed by flies, roaches, bugs, ants and other insects, all of which should be kept from the house. For practical lessons on the removal of these pests, see pages 39-50, Sections 1 to 24.

22. Furnishings. What constitutes the proper furnishing of a home, and by what principles one should be guided in furnishing a home, are two questions which should receive attention. The teacher can, by questions and the assignment of work, obtain from the members of the class their ideas on this topic, and the knowledge thus gained will furnish a good basis upon which to plan the lessons. In

giving their ideas, some of the girls will unconsciously describe their own homes or the homes of intimate friends. The lessons given should include the discussion of the following points:

(a) STYLE AND LOCATION OF HOUSE. A house located in the country, the suburb of a city, or in a small town or village, where it has plenty of light on all sides, will admit of very different treatment from a flat in a crowded city where light may possibly enter from only two sides and some rooms may never receive direct sunlight. Again, the furnishings should be in harmony with the size and style of the house. Massive furniture, for instance, is out of place in a cottage or small flat; however, in selecting light furniture one should take care to select that which is strong enough to be durable.

(b) MEANS. In planning the furnishing of the house, one should first determine the amount that can be expended, then make such selections within these limits as will make the home comfortable and at the same time have the furnishings harmonize in color and relative cost. To illustrate: a single expensive piece of furniture in a room where all other pieces are of moderate cost, seems out of place, and the money invested in it can be used more wisely in the purchase of a number of substantial pieces which, as a whole, will add more to the pleasure and comfort of the home because they are more useful. In general, a few well constructed, serviceable pieces of furniture are much more desirable than a larger number of cheap, showy pieces which must soon be repaired or replaced.

(c) THE ROOMS. Having discussed the foregoing principles, apply them to the furnishing of the different rooms—the kitchen, dining room, hall, living room and bedrooms. Interest can be increased by having each pupil write a description of her ideal of each of these rooms, then comparing the descriptions in class.

(d) ORNAMENTATION. The decoration of the walls is inseparable from the furnishings; in order that the home

may be the most enjoyable, the color scheme of the walls and the furnishings must harmonize. What this color scheme shall be depends upon the style and location of the home and the taste of the occupants. The most important features of the lessons on ornamentation consist in educating the taste of the pupils so that bright colors, cheap bric-a-brac and poor pictures will be excluded. Lead the pupils to realize that a few choice pictures and other ornaments to match, which harmonize with the walls and furniture, are much more satisfactory and in the end no more expensive.

(e) UNNECESSARY PURCHASES. In beginning a home it is usually wise to purchase only a part of the entire outfit which the occupants intend to procure. If the first purchases are confined to the necessities, other articles can be added from time to time as experience shows they are needed. Such a plan often prevents the purchase of articles which time proves to be unnecessary. But the lesson on unnecessary purchases should go a step further and show the folly of purchasing anything which is not needed simply because it is a "bargain." The happiness of many a family has been sadly marred, if not wrecked, at the bargain counter. Concerning the evil influence of this institution, Ellen H. Richards says: "What the liquor saloon is to the drinking man, the bargain counter is to the aimless woman." The following comment by the same authority shows the force of the statement:

"Go through a great department store, notebook in hand, and check off the articles which are valueless either for use or ornament, and those which with a semblance of either will lose the little value they have the first day of use; then go into the home for which the articles were destined and note the amount of money spent for these things in comparison with that spent for the essentials of good living and for the things which make for moral and mental advancement."[1]

[1] Ellen H. Richards: *The Cost of Living.*

23. Other Lessons. Besides the lessons outlined above, lessons on laundry work, the making of beds and marketing should be given. Besides these, numerous miscellaneous subjects will also suggest themselves to the teacher, each of which will be worthy of one or more lessons, if time permits.

SEWING

24. Introductory. Every girl should learn to sew during the school period of life. Country girls usually receive more home instruction in this art than those in town, but few girls in either town or country, however, receive systematic instruction in sewing, unless the lessons are given in school. In introducing this work into the intermediate and grammar grades, the teacher should be guided to a considerable extent by what the pupils have previously done. Sewing lessons can very profitably be commenced in the first grade. If this is done, the pupils have learned the first steps and also acquired some degree of skill by the time they reach the fourth grade. To repeat what they have previously done detracts from the interest of the work.

25. First Lessons. If the pupils have not received systematic instruction, they have doubtless acquired, along with whatever knowledge of sewing they have gained, certain bad habits which must be overcome before they can attain to a good degree of skill in the use of the needle. Therefore, lessons usually given in the first grade are in order, if they are needed to correct faults. These lessons will consist largely of drills in taking a correct position for sewing, in holding and threading the needle, and in holding the cloth. Unless the teacher is skilful in these things, she should study and practice until she has gained a good degree of facility in doing it before attempting to give the lessons.

26. What to Attempt. The extent to which this work can be carried will depend upon conditions. But here, as in other lines of domestic science work, the essentials should first receive attention. It is much more important that the pupils learn how to do plain sewing, patching and darning,

and to cut and make the common articles of underwear and simple dresses, than that they learn the various kinds of embroidery, however strongly the latter may appeal to them.

But ornamental work need not be wholly neglected; to be able to embroider well with her needle is an accomplishment of which any girl may be proud. The above warning is given in order that this line of work may occupy its true place and not usurp the position of what is of more vital interest.

Unless the teacher has taken a course of lessons for teaching this subject, she should be provided with manuals on teaching sewing, which give directions about the work and material, even to the minutest details. These manuals are so complete that the teacher can readily plan her lessons from them, and any teacher who possesses a fair knowledge of sewing need have no hesitation in attempting the work. The two books last named in Section 28 will be found especially helpful.

27. Supplementary Lessons. Interest in the work can be increased by giving lessons on the raw material from which fabrics are made. These lessons can be given in connection with the work in geography and elementary science, as has already been suggested in the chapters devoted to those topics. The production, preparation for market and manufacture of cotton, wool, silk, flax and other material from which textiles are made form a series of very interesting lessons. In connection with this instruction the pupils should learn to distinguish the different fibers, also the various fabrics made from each and the uses to which cotton, woolens, silks and linen are each especially adapted.

28. Aids. *The Cost of Living*. Ellen H. Richards. 156 pages. John Wiley & Sons. An inexpensive volume of remarkable value to the teacher and the home-maker.

Home Economics. Maria Parloa. 416 pages. The Century Co. This is a complete manual of household management and duties. It is helpful to the teacher in calling attention to and giving hints upon such lessons as ought to be presented in a course in domestic science.

Elements of the Theory and Practice of Cookery. Mary E. Williams and Katherine Rolston Fisher. 347 pages. The Macmillan Company. A work of great practical value to both teacher and pupil.

Chemistry of Cookery. N. Mattieu Williams. 328 pages. D. Appleton & Co. This is a plain and comprehensive treatment of the chemistry of foods and their preparation. It gives the teacher a foundation of knowledge upon which to build her lessons.

Food and its Functions. James Knight. 282 pages. Blackie & Son, London. This work gives a concise treatment of the constituents of food and the action of food upon the human system.

Handbook of Domestic Science and Household Arts. Lucy Langdon Williams Wilson. 407 pages. Macmillan Company. A practical and helpful teachers' manual, well adapted to the work of elementary lessons.

Progressive Lessons in Needlework. Catherine F. Johnson. 119 pages. Ginn & Co. A plain, practical work on such sewing as should be taught in the public schools. The lessons are fully illustrated.

Scientific Sewing and Garment Cutting. Wakeman & Hellar. 155 pages. Silver, Burdette & Co. A practical and instructive work for the more advanced grades.

TEST QUESTIONS

1. Describe three conditions which make teaching domestic science in the public schools necessary.

2. In what ways can you assist the girls in your school in making their homes more pleasant, and in making their services at home more valuable?

3. Name some of the most common sources of disease found about dwellings. How may each be removed? Explain fully.

4. Why is a knowledge of chemistry necessary to a thorough knowledge of cookery?

5. What principles of physics does every housekeeper need to know? Why?

6. What is protein? In what substances is it found? Why is it an essential ingredient of food?

7. Why is a mixed diet essential to maintenance of health? Explain fully.

8. Outline briefly a series of five lessons in domestic science which you could give in a school having no special equipment for this work.

9. Why should the economic side of household management receive special emphasis in schools?

10. Show how lessons in domestic science help to establish closer relations between the school and the home.

LESSON TWENTY-ONE

MUSIC

INTRODUCTION

1. Explanatory. As this lesson is intended to cover the work from the fourth to the eighth grades, inclusive, a concise resume of the work of the first three grades will aid in making it clear.

Dr. Hinsdale says, "We spend three years in learning to read, and all the rest of our lives in reading to learn." This may be said to be almost as true in music as in English. In the first three years the pupils have had their perceptions awakened to the two elements of music—tone and rhythm. They have learned the symbols for these elements in simple combinations; in other words, they can read simple exercises and songs. The foundation of their music education is laid in the primary grades, and for the average person the entire structure depends upon the sureness of this foundation. The later phases are but the development and growth of what is begun there. It is the purpose of this lesson to present a natural order of development and a simple method for the presentation of new points as they appear in the unfolding of the subject

The processes in learning music, as in language, are imitation, recognition, representation or symbolization, and interpretation or reading. As the pupils' powers of comparison and discrimination develop, less and less of the purely imitative process is used; but the order—recognition, representation and interpretation—remains the same, and can be applied to each new point. In the higher grades the three steps are not always distinctly marked. Sometimes new points may be developed in a reading lesson.

2. Graded Material. The teaching of music in a public school seems at first glance to be an enormous undertaking,

but with a well-graded course of study, a series of books in which the subject is developed gradually and systematically and the material well selected, most of the difficulty disappears. The great point is to have pupils learn to do, with facility, the work of each grade before taking up something more advanced. Because music is an art-study in which skill and power are the ends to be obtained, it is necessary to have material that gives many applications of each technical point. These technical points in music are not mastered by going over the same exercise, or the same song, many times, but by using many exercises, or songs, of practically the same grade.

The same principle is found in reading. The pupils master the vocabulary by having the same words in many different combinations—by reading much simple material before attacking new difficulties.

It is a mistake to attempt too rapid progress. Probably there are more errors made on this point than on anything else. There should be constant progression, constant gain in power; but new technical difficulties should not be presented so rapidly as to discourage pupils.

3. Work of First Three Grades. At the end of the third year, pupils should be able to read simple songs and exercises. They should be able to read in any key or any kind of measure when rhythm is simple, that is, when the notes represent a tone to a beat, or tones having two or more beats. They also should understand the so-called divided beats—the problem of two tones to one beat. In some courses three tones to a beat—the triplet—and four tones to a beat, are introduced in third grade. In addition to this, they should also have had some simple chromatic exercises.

Throughout these first three grades, much time has been spent in the singing of rote songs. In fact, the songs that are most interesting to primary pupils are often too difficult for their reading. From fourth grade on, however, rote songs are seldom necessary. While no valid objections can be offered to teaching rote songs in any grade, do not entertain

the mistaken notion that the only songs that interest the pupils are those which they learn in this way. They are much more interested in what they read, provided always the suggestion is followed of giving practice enough on each grade of material to enable the reading to be done with facility. Nothing so kills the spirit of a song as to have to struggle over its reading.

4. Rhythm and Tone. The two elements of music are time, or rhythm, and tune, or pitch. In planning a course of study, it is necessary to provide for the full development of each element. Every author of a graded course has attempted to keep the progress in the two elements about equal, some with more success than others. This lesson adheres to the order of development adopted by the majority of authors and the best authorities, so that the methods suggested can be applied to any series of books. Since there can be no music without the two elements of tone and rhythm, no exercise should be given without the two elements, unless it is absolutely necessary. A rhythm exercise may be, and should be, simple in tone. A tone exercise should be simple in rhythm. In writing an exercise, we often have to observe only one element at a time, but the separation of tone and rhythm should be avoided as much as possible.

5. Two Methods. Some teachers prefer to present all new problems by the purely imitative method. In the hands of a trained musician, who can skilfully lead from imitation to representation and interpretation, this method will be successful. For the average teacher with the average class, it is safer to show how the new problem is developed out of the old. In other words, to "proceed from the known to the related unknown." If, in certain cases, imitation seems to be the clearest and nearest route to the unknown, then it is the one to be followed. In the presentation of some problems, both plans will be suggested. The teacher should use the one which appeals most strongly to her.

FOURTH GRADE

6. Rhythm. The third grade rhythmic problem has two tones to a beat, of which ♩ = ♪ ♪ may be taken as the type. Most graded courses have this followed by what some call the beat and a half note, and others call the after-beat note. It does not matter so much what it is called, if the problem is understood as thus typified $\frac{2}{4}$ ♩. ♪. This is the use of a dot where it does not have the value of a full beat. The pupils have learned in the lower grades that a dot adds to the note half its original value. In the type given above, the dot has the same time value as an eighth note. Up to this time every tone or group of tones has always begun *on* the beat. In many instances a single tone has been held through two, or even three, beats, but it began with a beat. Now the problem is to sing a tone with the beat, hold it while the second beat is given, and have it followed by a short tone before the next following beat occurs. In order to do this, the pupils must have a strong feeling for the beat of the measure. This they will have if the rhythm work has been properly done in the preceding grades. In first presenting this problem, let the class observe, by listening, the movement in, say, the second measure of the tune *America*, or any other tune which contains this problem. It may be necessary to have them clap the measure. Persist in it until they hear that after-beat tone. When they have felt this rhythm in a song, show them how the technical point is developed by means of the following:

Teacher sings with la. 

She asks the class to sing it back to her with syllables, and then has someone write it on the board with correct meter signature, bars in the right place, and notes of the right kind.

Keeping the same tempo, the teacher then sings, and has the pupils write:

B

She then sings Exercise B again, this time tying the first three notes in each measure. The pupils know the use of the tie, and with a little questioning will write this:

Then ask for a different way to represent the same thing. It might be represented this way,

and it is well to have the pupils write it so.

But there is another and simpler way. We have a quarter note and an eighth note tied together. The time value of an eighth note is just half that of a quarter note. We have learned before, that if we want to add to a note one-half its original value, all that is necessary is to put a dot after it; so the pupil writes:

Have the pupils write the first two measures of *America*, or any other tune with which they are familiar and in which the problem ♩. ♪ occurs. After this, have them read a number of songs, or exercises, containing the same principle. The advantage in using exercises is that many short examples may be given. If songs are used, do not stop to have them finished for artistic singing, but read several, one after another. After the rhythmic principle has been fixed by a number of applications, the songs may be taken up for further study and polish. In these first applications, try to find exercises and songs that are simple in tune, that is, that contain no very difficult skips and no chromatics.

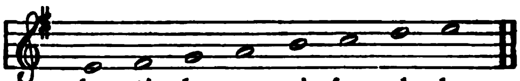
The principle once mastered, there is little difficulty in applying it to different kinds of measures, but it is well

to dictate exercises in three-four and six-part measure, as,

and

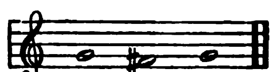
and

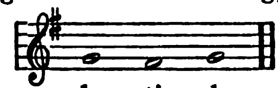
7. Tone. By the end of the third year, the pupils should have practically mastered the tones of the major diatonic scale. They should be able to read and sing any ordinary skip not involving chromatic tones. In the third year they have had presented sharp-four, and possibly flat-seven, so that they have a partial familiarity with these chromatic tones. They have learned, by rote, songs in the minor mode, so that the minor effect is not unfamiliar to their ears. They may have sung as a tone drill, without explanation of the mode, this exercise:



In the fourth year, the work in chromatics advances, and the minor mode is introduced.

8. Chromatics. To lead to the easy mastery of chromatic tones, take each tone in such combination with other tones as will be found in ordinary melodies; then, by comparison, present this same combination of tones in a key which will not require the use of chromatics to make the same tune. This will be clearer, if illustrated. The most commonly used chromatic is sharp four, called fi (fe). The combination sol fi sol in the key of C is written thus:



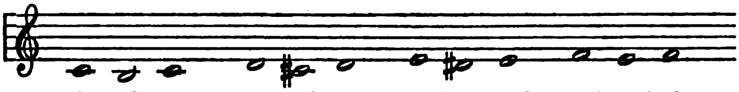
and the pitch names are g, f-sharp, g. Now if we write g, f-sharp, g, in the key of G, we have 

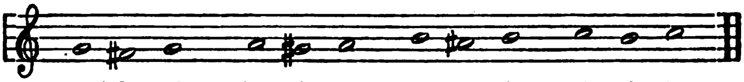
;

which sounds exactly like sol, fi, sol, in the key of C, and can be used as a pattern for sol fi sol.

It is not possible, without occupying extended space, to give the various combinations. The best guide for the development of chromatics is found in the *Natural Music Charts*, which may be obtained in pamphlet form. Do ti do is a pattern for re di re, mi re mi, sol fi sol, la si la, and ti li ti.

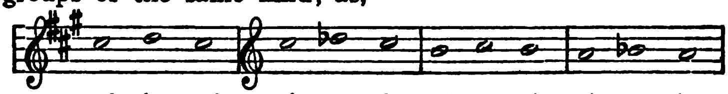
The ascending chromatic scale is easily sung in the following form:

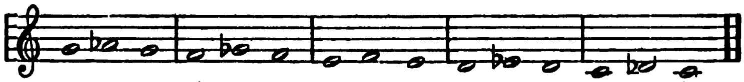




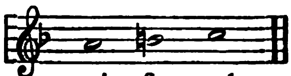
Each group has the effect of do ti do.

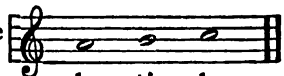
Mi fa mi can be taken as a pattern for do ra do and other groups of the same kind; as,



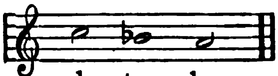


The sharp four approached from below is one of the early combinations studied. The combination

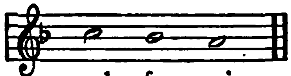


is in effect like 

Flat-seven is commonly used, and is taught by comparison with sol fa me; thus:



is like



Each teacher can work out the problems for herself as they appear in the material she is using, if she has a good knowledge of keys; and a little of this practice will increase her knowledge.

For instance, suppose the song is the familiar *Abide with Me*, in which this passage occurs:

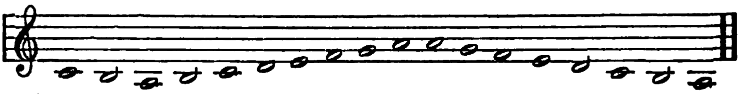
If the pupils have trouble singing mi fi sol, let them change mi to la, and sing:

When the tune is fixed, they can sing it with correct syllables in the key in which it is written. In this way most chromatic combinations can be worked out. Remember, however, that the end to be gained is to make the pupil so familiar with each chromatic tone that the device described will become unnecessary.

In every well graded course there are certain exercises and songs containing chromatics, which may be used for drill in securing pure intonation. The chromatic scale as a whole need not be attempted in this grade.

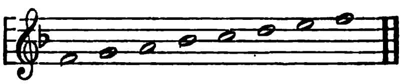
9. Minor Mode. In the third grade the pupils have become familiar with the minor effect in songs and tone drill. In the fourth grade they should learn the theoretical construction of the natural minor scale. As an introduction to this scale, have the class sing the major scale from do to do, in the key of C, for example. A higher pitch is better for the voices, but key of C is the best model.

Have them sing to la below lower do, then up from la to la above; thus,

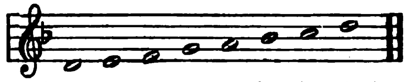


Explain that every major key has its relative minor key, which is a third below, or on la of the major. Explain further that the major scale and its relative minor have the same key signature. The major scale begins on do, while the minor begins on la. The rule for finding do from the key signature is still applicable only from this point, or pupils must look to the end of the exercise, or song, to determine the key. If it is major, it usually ends on do, and takes its name from the letter on which do occurs. If minor, it ends on la, and then it takes its name from the letter on which la is found. In the example given, the keys are C major and A minor. It is well always to use the terms *major* and *minor* in naming the keys. The form taught in this grade is the natural, or normal, minor, by some called the *old minor*. It uses the same tones as the major scale, but begins and ends on la; in other words, it is written without chromatic signs. After explaining the formation of the relative minor scale, have the class work out two or three scales by following the teacher's questioning and direction, the teacher writing the scales on the board.

Example: The teacher writes:



asking the class in what key this scale is written. They answer, "The key of F major." The teacher then asks, "Where is la in the key of F major?" The pupils reply: "On D." Then the relative minor scale of F major is D minor, written thus:

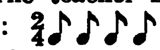
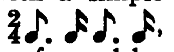


For practice, have the class write in their note books all the major scales, with their relative minors.

10. Tonic Chord. Drill the class in singing the tonic chord of the minor key—la do mi la—and when starting a song, or exercise, in a minor key, establish the key by singing the triad la do mi, if necessary, as you have sung do mi sol to establish the major key. This plan, pursued for a little time, will make the minor work very simple. In the dictation exercises give some very simple minor melodies.

11. Part Singing. Two-part songs and exercises should be used in this grade, but not exclusively. Pupils should not be allowed to sing the same part all the time. They all need the practice of singing each part, so the division may be made by classes, or rows, and the different divisions should change parts. Rounds and canons furnish good material for part singing here. Much unison material should be used, as it tends to preserve the voices, cultivate flexibility and increase the compass.

FIFTH GRADE

12. Rhythm. Following the usual plan, the rhythmic problem of the fifth grade is the unevenly divided beat, which may be represented thus: . This is taught very easily by rote, by comparing it with the evenly divided beat. The teacher may place upon the board an exercise like this: , which may be sung on one tone, or with a simple tune; then directly under it write and sing , contrasting the two movements—the two tones of equal length, and the tones of unequal length.

Another drill which can be used is to write an exercise like this:

First have the pupils sing, giving two beats to a measure, as it is written. After getting the swing, or movement, keep the same movement, but give only one beat to a measure. Then erase the bar and change the meter signature to $\frac{2}{4}$.

The same problem should be worked out in the different kinds of measure and by means of dictation exercises.

An excellent device for making pupils exact in time is to have them mark the notes on which the beat occurs; for example, take the first two measures of *The Battle Hymn of the Republic:*

and with some kind of a mark, possibly just a dot, indicate where the beat comes. Remember this is simply a device and should be used only when needed.

If the triplet has not been introduced before, it should come in this grade. It can be presented by comparison with $\frac{6}{8}$ meter when given with just two beats to a measure.

Another excellent plan for its presentation is to have the class read the following words:

Shimmering light

Sparkling and bright,

letting the accent fall as it naturally will, and represent it by notes as follows:

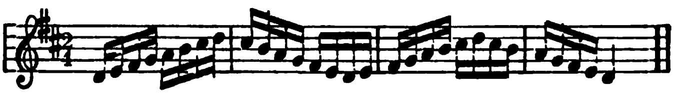
Shim mer ing light

Spark ling and bright.

Four tones to a beat are easily mastered as a doubling up of two tones. A good drill for the equally divided beat is to sing the scale with two tones to a beat, three tones to a beat, and four tones to a beat. This can be done in two different ways, as follows:

and down with the same movement, then

and



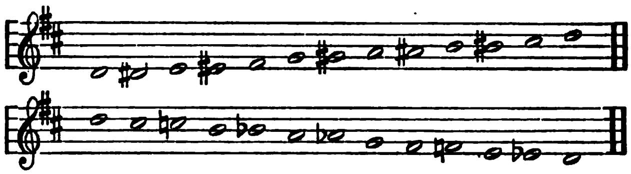
13. Chromatics. The work in chromatics in this grade is merely a progression to more difficult combinations, which can be simplified in the manner described in fourth grade. Pupils who have had thorough drill on sharp-four and flat-seven seldom have difficulty in singing the other chromatic tones.

Drill on the entire chromatic scale will help to secure correct intonation. To accomplish this object, an almost constant use of the pitch pipe is necessary. In the beginning it will be necessary to sound the pitch on several different tones of the scale. After some practice, it may be sufficient to test only on the last tone. Careful observation will show the teacher on which tones the class is likely to be untrue.

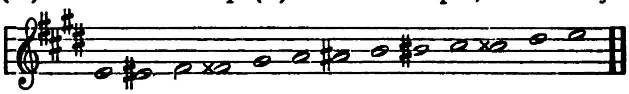
The chromatic scale can be written in any key. The syllables for the ascending scale are do, di,[1] re, ri, mi, fa, fi, sol, si, la, li, ti, do.[1]

Descending: do, ti, re, la, le, sol, se, fa, mi, me, re, ra, do.

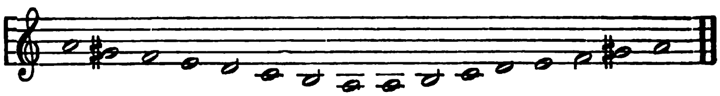
In the key of D the scale is written as follows:



Observe the scale is 1, ♯1; 2, ♯2; 3; 4, ♯4; 5, ♯5; 6, ♯6; 7; 8. And, 8; 7, ♭7; 6, ♭6; 5, ♭5; 4; 3, ♭3; 2, ♭2; 1, and in writing keep in mind what letters are sharped or flatted in the signature. In some cases it is necessary to use a double flat (♭♭) or double sharp (×). For example, in the key of E,



14. Minor. Teach the harmonic minor scale. This form is written like the natural form, except that the seventh tone is sharped. The syllable names are, ascending, la, ti, do, re, mi, fa, si, la; descending, la, si, fa, mi, re, do, ti, la. The interval from fa to si is an augmented second, and is one with which the pupils are not familiar. As a preparation for singing the harmonic minor, let the class first sing the natural form, then use the following exercises:



Have the pupils write the major scales in all keys with the relative minor in harmonic form. Remember it is the seventh of the minor that is sharped.

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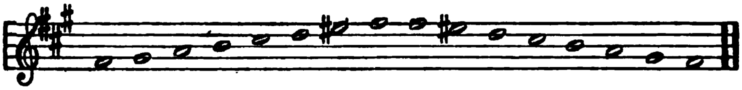
[1] *i* is pronounced like long *e*; *e* like long *a*, and *a* has the long Italian sound.

Example: A major

F-sharp minor



15. Part Singing. Three part music may be used in this grade, but not exclusively. There should be much practice in two parts and unison. Parts should be sung interchangebly.

SIXTH GRADE

16. Rhythm. The rhythmic exercises in the grades, with one exception, are simply the application in different combinations of the principles already developed. The exception is syncopation. *Syncopation* is an interruption of the regular accent. It is produced by prolonging a tone, which begins as an unaccented beat, over the point where the strong accent should occur, thus throwing the strong accent out of its usual place. You will find not much application of this principal in music courses. For an exercise to illustrate it, take the scale in the following manner:

Then tie the notes as follows:

Then the same effect is represented as follows:

Be very careful to keep the beat even. At first it may be necessary to beat in some audible manner, but do not continue that practice.

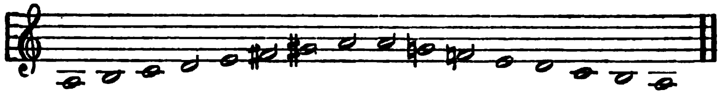
17. Chromatics. Chromatic work in this grade will consist of exercises and songs including chromatic tones in various combinations, which can be worked out, if necessary, according to the plan suggested in the fourth grade. Use that device only when the pupils have difficulty in singing the chromatic tones.

Drill on the chromatic scale occasionally, but not long at one time. Have the pupils write the chromatic scale in different keys. Give dictation exercises containing chromatic tones.

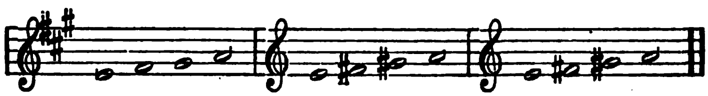
18. Minor. Review the natural and harmonic forms of the minor scale, and teach the melodic form.

In the melodic minor scale, the sixth and seventh tones are sharped in ascending, and made natural in descending. The syllable names, ascending, are, la, ti, do, re mi *fi si* la; descending, la *sol fa* mi re do ti la.

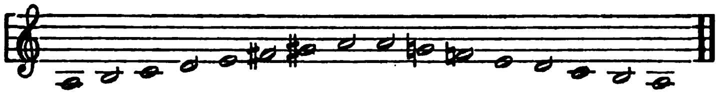
In the key of A minor it is written:



The difficulty in this scale is mi, fi, si, la. As a preparation have pupils sing sol la ti do, which sound the same; thus,



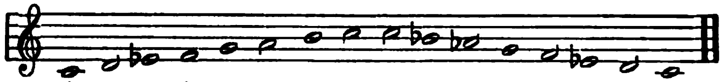
Then again,



The descending scale in melodic form is just the same as in the natural form, with which the class is quite familiar.

There is one other minor form which may be taught here, as it is in effect like the melodic minor. It is called the

tonic minor, and is formed on do of the major scale. It is written:



In the ascending scale the third is flatted. In the descending scale, the seventh, sixth and third are flatted. Have pupils write major scales with relative minor, melodic form, also the tonic minor melodic form. If there is trouble in singing the tonic form, have class practice the do re me by comparison with la ti do.

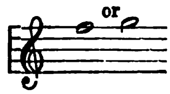
Thus,

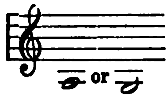
Then,

After which,

Then,

19. Part Singing. In the sixth grade the voices should be tested to determine for which parts they are best suited. Do not allow all the boys to sing alto, regardless of their voices. Many boys in sixth grade still have high soprano voices. Others can take second soprano, and still others the lowest part, or alto. Do not allow a girl with a high soprano

voice to sing alto, just because she is musical and can carry the second part. Irreparable damage is sometimes done by this practice. The part a voice should sing is determined more by the quality of the voice than by the compass. If the quality is right, the compass will usually be developed by singing. Sopranos should be able to sing to 

Alto down to 

As a rule, there are no changed voices among the boys in this grade. Unison singing should continue.

SEVENTH AND EIGHTH GRADES

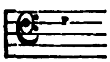
20. Aim. It should be the aim in the seventh and eighth grades to have the pupils become acquainted with as much good music as possible. In the six grades below, there have been presented to them practically all the technical principles necessary for reading music. From this point on, they should know and enjoy the best compositions that lie within the scope of their abilities.

21. Review. Technical knowledge should be reviewed. This can best be done by means of written work. During each year have the pupils write the major scales, with their relative minors in different forms, and the chromatic scale in several different keys. Be sure that key signatures are well fixed, and meter signatures thoroughly understood. Pupils should be able to write from hearing simple melodies. A good drill for this purpose is to have them write tunes with which they are familiar. These are to be written from their memory of how the tune sounds, not how it looks on the page; in other words, not copied from the book. This is the best test of their knowledge of rhythm forms. If the class is found to be weak on any of these technical points, pursue the plan suggested for the first presentation and

drills of the same principle. Bear in mind, however, that each reading lesson is practically an application, and the best application of many technical points.

22. Bass Clef. The voices of many of the boys will change in these grades, so that it is necessary to introduce the bass clef. To simplify this, explain the use of the clef signs and also the great staff. Show them that middle C belongs to both staves, as follows:

Reading in the bass clef is just the same as in the treble clef, once the position of do is fixed. This clef is called



the *F clef* and shows that F is on the fourth line, just as the treble clef is called the *G clef* and fixes the position

of G on the second line

Have pupils practice writing key signatures in both clefs; also have the entire school practice reading the bass. Some music courses give a number of unison exercises in the bass. If you do not find them in your books, have the entire school read the bass of some of the part songs, the girls, of course, singing an octave higher than the boys with changed voices.

23. Part Singing. Three-part songs and exercises should be used in seventh grade; three-part and four-part in eighth. Some unison singing should continue throughout both grades. Have the class read all parts together at the first reading of exercise or song. This saves time, gives them a better feeling for the harmony, and is what they will have to do if they enter a choir or choral society. If there are certain particularly difficult places for any one part, have that portion sung alone by those carrying that part, or have the entire chorus read the difficult portion.

GENERAL SUGGESTIONS

24. Sight Reading. Sight reading is not an end, but a means to an end. As stated at the beginning of the lesson, we first learn to read, and then read to learn. It is as necessary to the full enjoyment and understanding of music that one be able to interpret the printed symbols easily and readily as it is to be able to read English in order to enjoy literature. Reading should be an interpretation, and not a mere calling of tones. As in English, so in music one learns to read by reading. In selecting material, choose books that will give you an abundance of simple work in the beginning, and that present for each grade many songs and exercises that are simple for that grade. New technical principles, with their applications, must come in each grade, but if all the material is of the highest grade of difficulty there is too much plodding and the spirit of the music is sacrificed. There should be some reading of new material every day. Cultivate the habit of reading the exercise correctly the first time. To do this, it is well to have the class understand that they will have only one trial. Read straight ahead a number of exercises or songs, even if they are not read with perfect accuracy. After covering two or three pages in this way, go back and read again those which were not perfectly rendered. If in the material so read there is a song which is attractive, take it up at the beginning of the next lesson and read it again. You will find that the second reading is much easier than the first, particularly if in the meantime something more difficult has been attempted. Two or three readings in this manner will bring mastery of the technical part of it, and then further time should be given to artistic interpretation and finish. Reading through to the end of a selection is also a matter of habit. Some schools have the habit of reading a measure or two, and then going back to the beginning. The second time they read a measure or two farther and then stop, and so on until finally they plod through the entire exercise. They should, the first time through, grasp the composer's

idea, even if they miss some of the niceties of his expression; that can come in a second reading.

25. Interval Drill. With plenty of material for practice in sight reading, there is little need for so-called interval drill. Just before taking up a new song, or a series of exercises, a quick drill may be given to help the pupils locate the tones in that particular key. To do this, the teacher writes the notes on the staff, the pupils responding with the tones by syllables as fast as the teacher writes. If there is a particularly difficult interval, give special attention to it by repeating it several times in the drill. The entire drill should not take more than two or three minutes.

26. Interpretation. It is not possible to make too strong a plea for the interpretation of the songs. This is commonly called singing with expression. Any teacher who can bring out expression in the reading of a poem, or a beautiful bit of prose, can, by the same means, call forth an expressive rendering of a song. The difference between artistic singing and mechanical vocalizing, be it ever so correct, lies in the artist's ability to feel and express what the poet says. The composer emphasizes and embellishes what the poet expresses in words. The signs *forte* and *piano*, *crescendo* and *diminuendo*, *accelerando* and *retard*, are but the composer's suggestions, and are unnecessary to the person who reads the poem understandingly. More than that, they usually fit only the first stanza, and the other stanzas may call for quite a different rendering.

A few rules to bear in mind are the following:

(1) Enunciate clearly and distinctly.

(2) Dwell on the vowel sounds.

(3) Where a word is held for a long tone, hold it on the vowel, and pronounce the final consonants just at the end of the tone.

(4) Phrase the singing as you would phrase the reading of the poem.

(5) Do not breathe between the syllables of a word.

(6) Do not breathe between a preposition and its object.

(7) Do not breathe between a verb and its object.

(8) Careful attention to correct phrasing will give the desired breath control.

27. Voice. It is not the province of public schools to give lessons in so-called vocal culture. It should be the province of the teacher to preserve the voices and cultivate good habits of vocalizing.

By some, soft singing is considered a panacea for all vocal ills; but there are several other rules to be observed:

(1) Do not, on any account or at any time, allow hard, harsh singing. Some songs require more volume of tone than others. This is a matter that should be regulated by the interpretation of the song.

(2) Keep the pitch high, and ask for a clear, light, sweet tone.

(3) Practice singing the descending scale. Also practice singing sustained tones.

(4) Have much unison singing throughout the grades.

(5) Do not let pupils below sixth grade sing any one part exclusively, unless the voice is an exceptional one.

(6) Continue unison singing throughout all grades. Every well arranged graded course provides unison songs and exercises, even in the eighth grade.

Caution. Be sure that those few simple rules are followed at all times. Do not ever accept a harsh, loud tone, no matter if the exercise is simply an interval drill. Insistance on good tone always will do more than the practice of many vocal drills.

28. Written Work. "Writing maketh an exact man." Two of the chief benefits derived from written work are accuracy and self-reliance. In the foregoing lessons are given sugges-ions for the writing of scales. It is a good plan to have the pupils use note books which are ruled for music writing. In these they can write their scales, and keep them for future reference.

29. Dictation. In Section 1 it is stated that the processes in learning music are imitation, recognition, representation

and interpretation. Dictation involves two of these, namely, recognition and representation. In dictation, the teacher sings, or plays, a tune; it may be a very small one, and the pupils write what they hear. This exercise serves several purposes. It can be used for the first presentation of technical points as they appear in the development of the subject. This use is set forth in detail in the fourth grade outline (Sections 6-11), and the same general plan can be pursued in all succeeding lessons. For the first presentation of a technical principle, the exercise should be simple in all other respects, so that the attention can be centered upon the one new principle. The same is true of the drill exercises which should follow the presentation, in order to make this new principle and its representation a part of the pupil's working knowledge.

Besides this use for the presentation of new points, occasional dictation exercises will quicken the pupils' musical intelligence, make them better readers, and strengthen them in all lines. For this purpose, the exercises should be complete melodies that embody the various technical points presented up to that particular grade. In other words, the dictation exercises should be similar in construction to the exercises then being read by the class. If the teacher cannot make her own melodies for this purpose, she can select phrases from the exercises and songs in the text-book in use, being careful to select those which the pupils have not memorized. Sometimes it is a good plan to select phrases from the material which is to be used for sight reading practice in the same lesson, using it first for dictation and afterwards for reading. Another valuable exercise is to have pupils write complete tunes which they have learned by ear.

The third use for dictation is as a test of technical knowledge. For instance, instead of asking the pupils, "What is the signature for the key of E," or, "How many quarter notes to a beat in $\frac{3}{4}$ measure,"sing a melody in 3-part measure, including in some portions two tones to a beat. Ask the pupils to write this melody in the key of E. If they write

it correctly, they have given the best answers to the questions.

30. Rhythm. A great deal is said and written about rhythm exercises, but a few simple rules, faithfully observed, are better than many rhythm drills. In the first place, take every selection, be it exercise or song, in good tempo; do not drag. Then observe the accent. Remember that rhythm is "measured flow." Let the music move along, and its movement be measured by the accent. It is the accent that makes the measure, and the bar across the staff simply shows where the accent should occur. Insist that the singing be done so that a person listening, but not seeing the notes, could tell in what kind of measure the selection is written. Be sure that the pupils *feel* the measure, and that they give to each note its exact value, and rhythm will take care of itself.

31. Individual Work. Have each pupil read an exercise, or part of a song, alone, once a week if possible. This can easily be done in the lower grades, and the pupils of the upper grades will not object if you make them feel that music is just like other studies, such as reading, arithmetic and geography. Each one is expected to do the best he can. This practice, together with the written work, will make each member of the class independent.

32. Use of Pitch Pipe. Never trust to your own voice or that of a pupil to pitch the songs or exercises; always use the pitch pipe. Use it at the beginnning to establish the pitch, and use it at the end to see if the true pitch has been kept. Sometimes you can overcome the habit of flatting by this simple means.[1]

33. Original Composition. Unless you yourself are familiar with the rules for melody writing, and feel perfectly competent to lead the pupils into correct musical expression, do not attempt original composition.

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[1] The Congdon Pitch Pipe gives the key note for ten tunes. It can be obtained of C. H. Congdon, 378 Wabash Ave., Chicago. This little device is inexpensive and is often of great assistance.

34. Definitions and Terminology. It is beyond the scope of these lessons to give definitions of words and terms used in music. A word of caution may be offered: Be careful to use exact terms. Webster's *International Dictionary* will give you the correct definition and use of nearly every term to be found in your music texts. Use the dictionary.

35. The Recitation. There is no other lesson in which absolute attention and concentration of all powers of the mind are more necessary than in music. In fact, this is one of its chief educational values. Bring to this recitation all the enthusiasm you have, and make it one of the happiest periods of the day. Demand and keep the entire attention of the class. Have an objective point in every lesson. Plan the lesson so that every minute shall be used to advantage. Do not dwell too long on one exercise or drill. All principles of pedagogy that you use in other subjects will apply to music.

Keep the work moving; let pupils feel that they are progressing, and they will always be interested.

TEST QUESTIONS

1. What ground should be covered in the first three grades?
2. What technical points should be developed in fourth grade?
3. What technical point developed in fifth grade. Give an exercise of your own for developing the harmonic minor scale.
4. What technical points are developed in sixth grade? Give an exercise for developing the melodic minor scale.
5. What two methods are suggested?
6. How would you develop the ♩. ♪? The triplet?
7. What plan may be used to simplify the reading of chromatics? What is the pattern for la si do?
8. How would you develop rapid and independent reading? How would you secure correct and artistic interpretation?
9. What is dictation? Of what value is it?
10. Give rules for the preservation of voices.

INDEX

Roman Numerals I and II refer to Volumes.